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IUPAC Nomenclature

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IUPAC Nomenclature

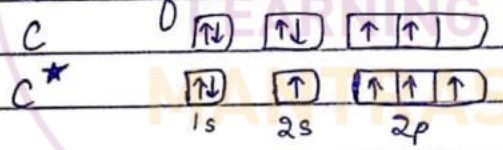
Organic Chemistry is the study of compds. containing carbon.

C
3 isotope

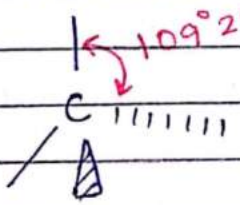
$^{12}_{6}C$	$^{13}_{6}C$	$^{14}_{6}C$
98.8 %	1.1 %	0.001 %
A = 12		half life = 5730 yrs
Z = 6		

Characterstic of C :-

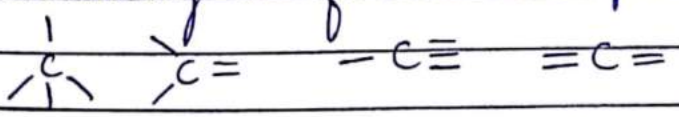
1. Tetravalent : C form 4 bond in excited state.



2. Tetrahedral : 4 bonds are directed towards corner of ~~of~~ ~~tetrahedron~~.



3. Tendency to form multiple bond :



4. Catenation : Self linking property of C to form long chain.

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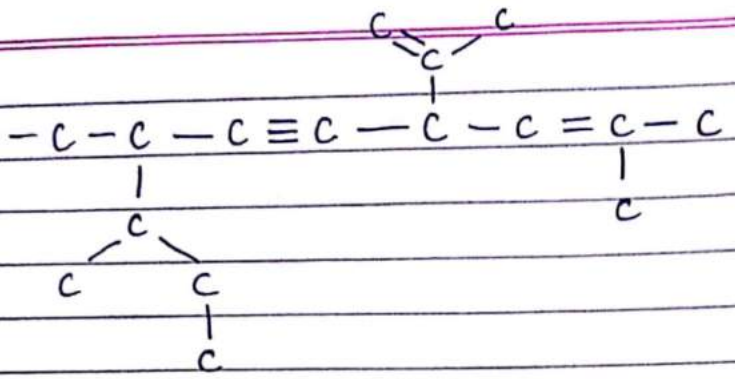
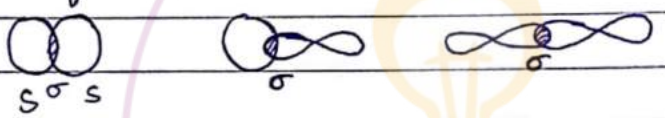
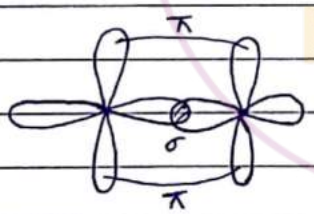


5. Hybridisation :-

σ bond : It is formed by coaxial overlapping of atomic orbitals.



π-bond : formed by colateral / sidewise overlapping of atomic orbitals.



Note :- ① σ bond is stronger than π-bond becoz extent of overlapping is more in σ bond.

② π-bond is more reactive than σ-bond.

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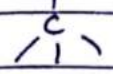
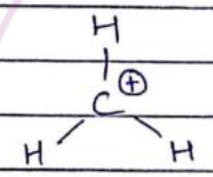
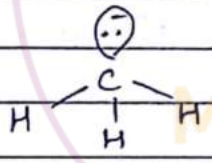
Str.	σ, π bond	hyb.	B.A.	Shape
	4, 0	sp^3	109°28'	tetrahedral
	3, 1	sp^2	120°	trigonal planar
$-C\equiv$	2, 2	sp	180°	linear
$=C=$	2, 2	sp	180°	linear

S.No. = no. of σ bond + no. of lp.

CH_3^+  sp^2

CH_3^-  sp^3

E.N. ∝ % S-Char

	sp	sp^2	sp^3
% s char	1/2 × 100 = 50%	1/3 × 100 = 33.3%	1/4 × 100 = 25%

E.N. → sp (3.25) > sp^2 (2.75) > sp^3 (2.5)

B.L. ∝ $\frac{1}{E.N.}$ $sp < sp^2 < sp^3$

B.S. ∝ E.N $sp > sp^2 > sp^3$

Or

B.S. ∝ $\frac{1}{B.L}$

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Ques Find hyb. of underlined C ?

1. $CH_3-\underset{\underset{OH}{|}}{\underline{C}H}-CH_2-\underset{\downarrow}{\underline{C}H}=CH_2$
   $OH \rightarrow sp^3$; $\underline{C}H \rightarrow sp^2$

2. $CH_3-CH_2-\underline{C}\equiv N$
   $\underline{C} \rightarrow sp$

3. $CH_3-CH=CH-\underset{\downarrow}{\underline{C}H_2}-\underset{\underset{O}{\|}}{\underline{C}}-CH_3$
   $\underline{C}H_2 \rightarrow sp^3$; $\underline{C}(=O) \rightarrow sp^2$

4. $CH_3-\underset{\underset{O}{\|}}{\underline{C}}-CH_2-\underline{C}OOH$
   $\underline{C}(=O) \rightarrow sp^2$; $\underline{C}OOH \rightarrow sp^2$

5. $CH_3-\underset{\underset{OH}{|}}{\underline{C}}=CH-\underline{C}H_2-Cl$
   $\underline{C}(OH) \rightarrow sp^2$; $\underline{C}H_2 \rightarrow sp^3$

Ques Find hybridisation of C-C single bond

$HC\equiv\underset{\downarrow}{\underline{C}}-\underset{\downarrow}{\underline{C}}H=CH_2$
$\underline{C} \rightarrow sp$; $\underline{C}H \rightarrow sp^2$

Ques Find hyb. of C_2 & C_3 in following

$\overset{6}{H}\overset{5}{C}\equiv\overset{4}{C}-\overset{3}{C}H_2-\overset{2}{C}H_2-\overset{1}{C}H=CH_2$
$C_3 \rightarrow sp^3$; $C_2 \rightarrow sp^2$

Ques Find hyb. of Carbonium ion ?

$\overset{\oplus}{C}H_2 \rightarrow sp^2$

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Ques find no. of σ & π-bond in following?

1. $CH_3 - CH_2 - CH_2 - OH$ 11σ

2. $CH_3 - CH_2 - CH = CH_2 - OH$ $13\sigma, 1\pi$

3. $CH_3 - CH_2 - CN$ $8\sigma, 2\pi$

4. $CH_3 - CHO$ $6\sigma, 1\pi$

5. $CH_3 - COOH$ $7\sigma, 1\pi$

6. $CH_3 - \underset{\underset{O}{\|}}{C} - CH_2 - COOH$ $12\sigma, 2\pi$

7. $CH_3 - \underset{\underset{OH}{|}}{C} = CH - COOH$ $12\sigma, 2\pi$

NT
8. $CH_2 = CH - C \equiv CH$ $7\sigma, 3\pi$

NT
9. $CH \equiv C - CH_2 - C \equiv C - CH_3$ $11\sigma, 4\pi$

AIIMS
10. $CH_2 = CH - CH_2 - CN$ $9\sigma, 3\pi$
allyl cyanide

IIT
11. Toluene $15\sigma, 3\pi$

DEC
12. Styrene $16\sigma, 4\pi$

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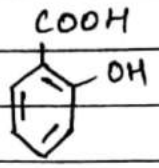
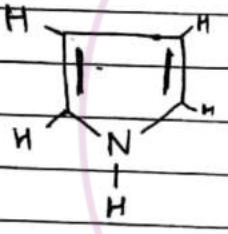
13.  $16\sigma, 4\pi$

14. $14\sigma, 1\pi$

15. $23\sigma, 2\pi$

16.  $10\pi, 2\pi$

Ques Arrange following in ↑sing order of B.L.?

① $\underset{sp}{\overset{x}{CH\equiv CH}}$ $\underset{sp^3}{\overset{y}{CH_3-CH_3}}$ $\underset{sp^2}{\overset{z}{CH_2=CH_2}}$

B.L. $\propto \frac{1}{E.N}$

$y > z > x$

② $\underset{sp}{\overset{a}{CH\equiv C-H}}$ $\underset{sp^3}{\overset{b}{CH_3-CH_2-H}}$ $\underset{sp^2}{\overset{c}{CH_2=CH-H}}$

$b > c > a$

③ $\overset{\alpha}{CH_3-CH=CH_2}$ $\overset{\beta}{CH_3-C\equiv CH}$ $\overset{\gamma}{CH_3-CH_2-CH_2}$

$\gamma > \alpha > \beta$

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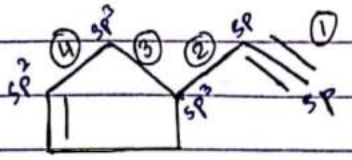
JIT

(4)



~~2 = 3 > 4 > 1~~

3 > 4 > 2 > 1

B.S. ① > ② > ④ > ③

Type of Carbon and Hydrogen :-

1. Primary Carbon & Primary Hydrogen :-

1°C → C which is attached to only 1° carbon.

1°H → H which is attached to only 1° C.

$$\underset{1^\circ}{CH_3}-\underset{}{CH_2}-\underset{|}{CH}-\underset{}{CH_2}-\underset{|}{CH}-\underset{}{CH_2}-\underset{1^\circ}{C}\equiv N$$

$$\underset{}{CH_2-Cl}\ (1^\circ) \qquad \underset{}{CH_2-OH}\ (1^\circ)$$

1°C → 4

1°H → 6

2. Secondary Carbon & Secondary Hydrogen :-

2°C → C which is attached to 2° carbon

2°H → H which is attached to 2° C.

$$\underset{1^\circ}{CH_3}-\underset{2^\circ}{CH_2}-\underset{|\ 2^\circ}{CH}-\underset{}{CH}-\underset{||\ 2^\circ}{C}-\underset{1^\circ}{CH_3}$$

(Cl on the CH; O on the C; $2^\circ CH=CH_2^{1^\circ}$ on the CH)

2°C → 4

2°H → 4

3. Tertiary Carbon & Tertiary Hydrogen :-

3°C → C which is attached to 3 carbon.

3°H → H which is attached to 3° C.

$$CH_3-\underset{|}{\overset{CH_3}{\overset{|}{C}}}^{3^\circ}-CH_2-\underset{|}{\overset{3^\circ}{CH}}-CH_2-\underset{|}{\overset{H_3C-\overset{3^\circ C}{CH}-CH_3}{CH}}-CH_2OH$$

(Cl on the quaternary C; CH_3 on the 3° CH; 3°C on the CH)

3°C → 4

3°H → 3

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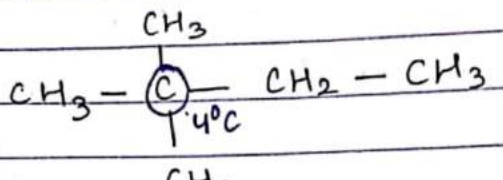
4. Quaternary Carbon :-

4°C → Carbon which is attached to 4 carbon atom



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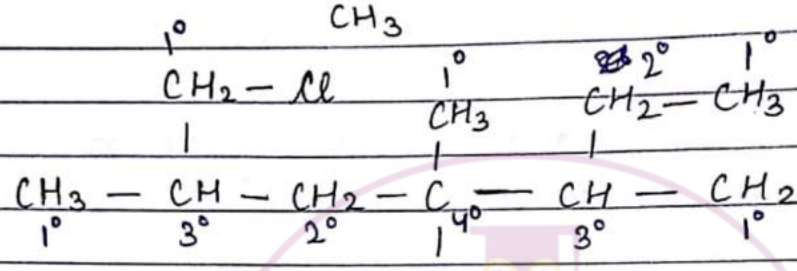
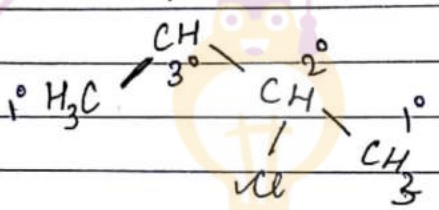




1°C → 7C
1°H → 19H
2°C → 3C
2°H → 5H
3°C → 3
3°H → 3
4°C → 1

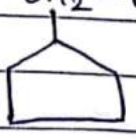
Type of Alcohol :-

1. Primary Alcohol :- (1° OH) The alcoholic compd. in which OH gp. is attached to 1°C.

CH_3-CH_2-OH

$CH_3-CH_2-CH_2-OH$

CH_3-OH



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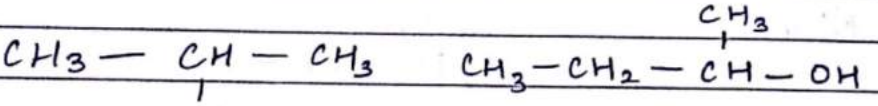
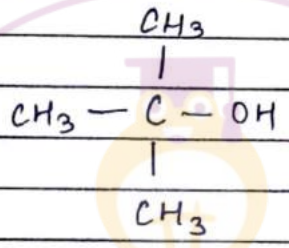
2. Secondary Alcohol : The compd in which OH gp. is attached to 2°C.

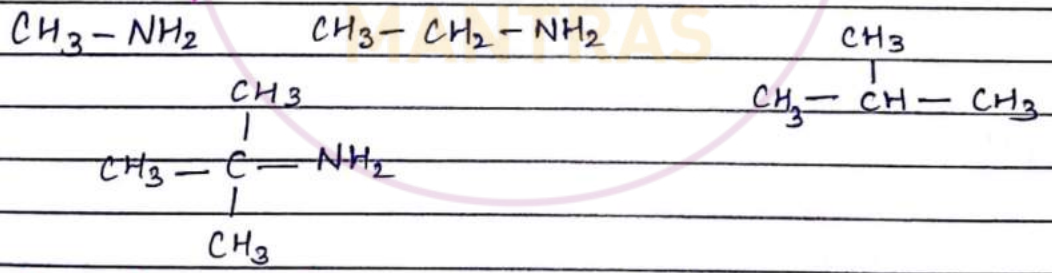


3. Tertiary Alcohol : The alcoholic compd. in which OH gp is attached to 3°C

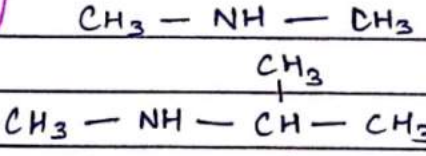


Type of Amine :-

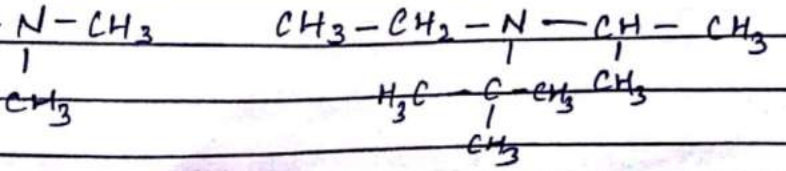
1. Primary Amine : N is attached to only 1 C atom.



2. Secondary Amine :- N is attached to 2 C atom.



3. Tertiary Amine : ~~Sn~~ in ~~which~~ N is attached to 3 C atom.



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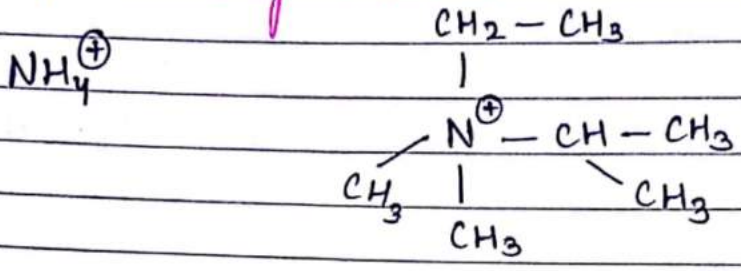
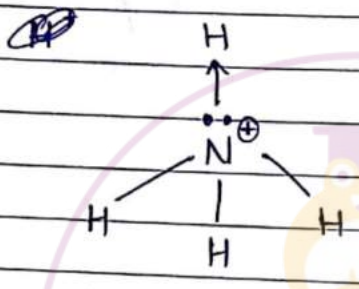
4. Quaternary amine : N is attached to 4C atom.





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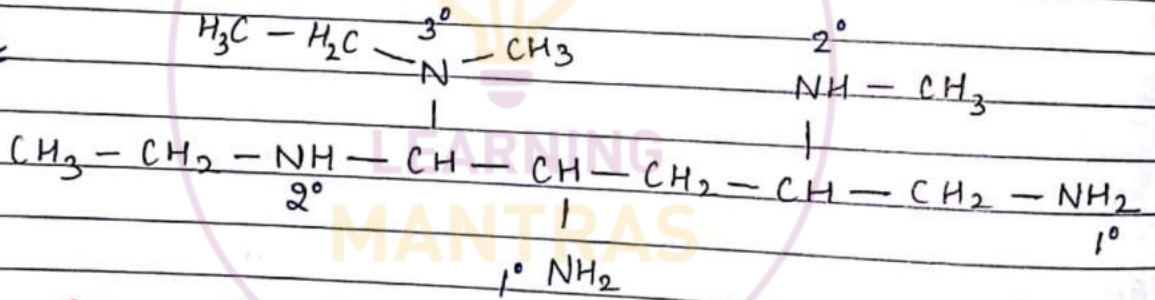

Classification and Nomenclature

Classification :-

1. Based on structure
2. Based on Group
3. Based on Homologous

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① Based on structure :-

- Open chain / aliphatic / acyclic
  - Saturated — C–C
    - + alkanes
    - C_nH_{2n+2}
    - Paraffins
    - $CH_3-CH_2-CH_3$
    - $CH_3-\overset{\overset{O}{\|}}{C}-OH$
    - $CH_3-CH=O$
  - Unsaturated
    - C=C — Olefinic bond — alkene — C_nH_{2n}
    - C≡C — acetylinic bond — alkyne — C_nH_{2n-2}
- Closed chain / Cyclic
  - Homocyclic
    - alicyclic
    - aromatic
  - Heterocyclic
    - Alicyclic
    - Aromatic
      - Pyridine
      - Pyrole

Ques Which of the following is unsaturated compo

1. C_3H_8 ×
2. CH_3-CHO ×
3. CH_3-COOH ×
4. C_3H_4
5. $CH_3-CH_2-CH_2-OH$

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6. $CH_3 - CH = CH - CH_3$

7. $CH_3 - \underset{\underset{O}{\|}}{C} - NH_2$

8. $CH_3 - \underset{\underset{O}{\|}}{C} - O - CH_3$

9. $CH_3 - C \equiv CH$

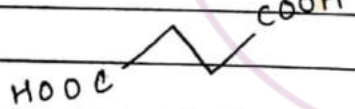
10. $CH_3 - CH_2 - \underset{\underset{\underset{O}{\|}}{C - O - CH_3}}{\overset{|}{CH}} - CH_3$

11. $CH_3 - CH_2 - CH = \underset{Cl}{\overset{|}{C}} - CH_3$

12. $CH_3 - CH_2 - CH_2 - NH_2$

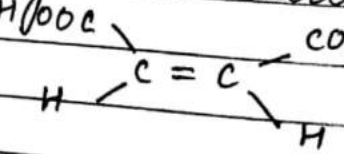
13. $CH_3 - CH = CH - CH_2 - NH - CH_3$

14.

15. 

16. ~~$CH_2 = CH$~~

Ques Which of the following is unsaturated?

1. Maleic acid 

2. Succinic acid $\begin{array}{l} CH_2 - COOH \\ | \\ CH_2 - COOH \end{array}$

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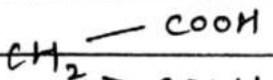
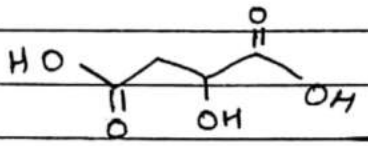
3. Malonic acid 

4. acetic acid CH_3-COOH

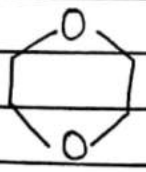
5. Malic acid 

A :- Acetic acid is not an unsaturated compd. ✓
R :- acetic acid do not have olefinic ~~comp~~ bond. ✓ (2)

A :- acetic acid is saturated compd. ✓
R : acetic acid have $-\overset{\overset{O}{\|}}{C}-$ bond. ✓ (2)

A : acetic acid have $-\overset{\overset{O}{\|}}{C}-$ bond.
R : acetic acid is saturated compd. (2)

Ques find no. of heteroatoms in following ?

(1)  2

2. 1

3. 1

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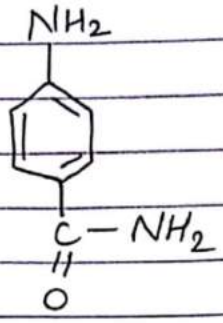
4. 

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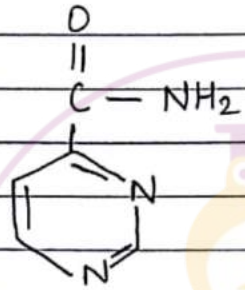
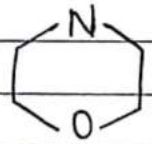
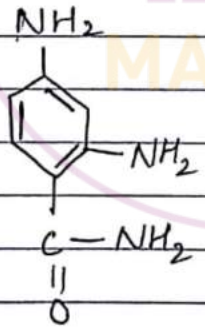
5. 

2

6. 

2

7. 

O

(2) Classification based on Group :-

$R-H \xrightarrow[-H]{+G_1} R-G$

Hydrocarbon — hyd-radical — (G) func^n gp.

hyd-radical → phy. property → B.P., M.P. & density etc

(G) → + chemical property

- $-OH$
- $-NH_2$
- $-X$
- $-COOH$
- $-CH=O$

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Pentyl = amyl

Hydrocarbon Radical (R–) :-

Saturated :

Monovalent :-

alkane $\xrightarrow{-H}$ alkyl

CH_4 $\xrightarrow{-H}$ CH_3-

Methane — Methyl

CH_3-CH_3 $\xrightarrow{-H}$ CH_3-CH_2-

ethane — ethyl

$CH_3-CH_2-CH_3$ (Propane) $\xrightarrow{-H}$ $CH_3-CH_2-CH_2-$ n-propyl

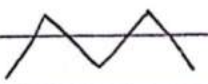
$CH_3-CH_2-CH_3$ (Propane) $\rightarrow$ $CH_3-\underset{|}{CH}-CH_3$ iso-propyl

Normal :- • straight chain hydrocarbon
• no branching

eg

$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$

n-butane — n-hexane



propane — n-pentane — n-heptane ($CH_3(CH_2)_5CH_3$)

$CH_3-CH_2-CH_2-$ n-propyl

$CH_3-CH_2-CH_2-CH_2-$ n-butyl

Iso : When methyl gp. is attached at 2nd last C or 2nd C (in case of alkanes) is c/a iso-comp.

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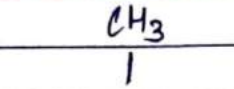
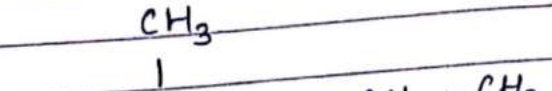
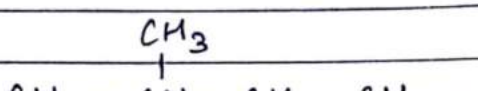
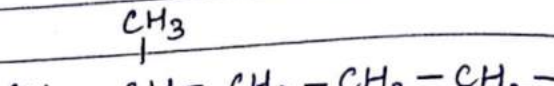


iso-butane

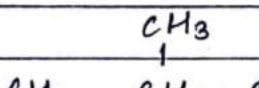


iso hexane

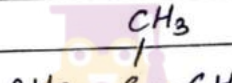




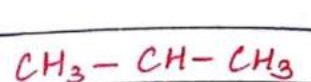
iso hexyl



iso-butyl

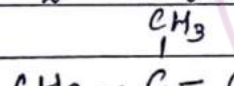


t-butyl

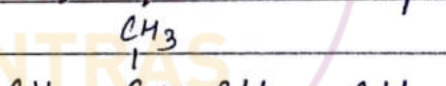


isopropyl

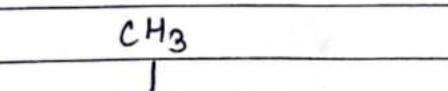
Neo :- When 2 methyl gp. is attached to 2nd last C or 2nd C (in case of alkane) c/a neo compd.



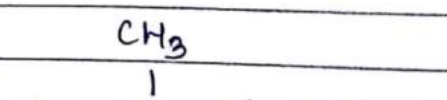
neo-Pentane



neo-hexane

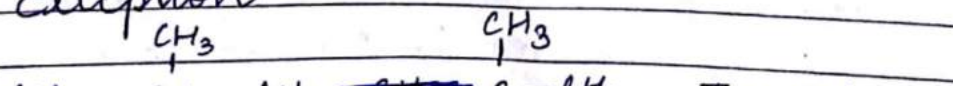


neopentyl



neo hexyl

Exception



Iso-octane

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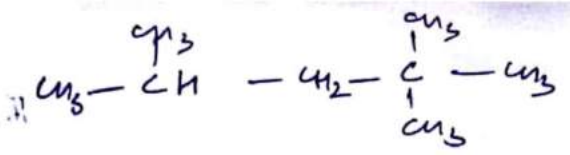

iso octane

$CH_3 - CH_2 - CH_2 - CH_2 - CH_2 -$ n-pentyl

$CH_3 - CH_2 - CH_2 - \underset{|}{CH} - CH_3$ Sec. pentyl

CH_3

$CH_3 - CH - CH_2 - CH_2 -$ iso · pentyl

CH_3

$CH_3 - C - CH_2 -$ neo pentyl

CH_3

Bivalent :- 2 valency free
from same C - atom → alkylidene
from vicinal C - atom → alkylene
terminal C - atom → polymethylene

$CH_4 \xrightarrow{-H} CH_3 - \xrightarrow{-H} CH_2 =$

Methylidene
or
Methylene

$CH_3 - CH_3 \longrightarrow CH_3 - CH_2 - \longrightarrow CH_3 - CH =$ ethylidene

$\searrow$ $CH_2 - CH_2$ ethylene
| |

$CH_3 - CH_2 - CH_3 \rightleftharpoons CH_3 - CH_2 - CH =$ propylidene

$CH_3 - CH_2 - CH_2 -$ propylene
|

$CH_3 - \underset{\diagup\diagdown}{C} - CH_3$ isopropylidene

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$-CH_2-CH_2-CH_2-CH_2-$

$CH_2=CH_2 \longrightarrow CH_2=CH- \longrightarrow CH_2=C^-$

Vinyl or ethenyl — ethenylidene

$CH_3-CH=CH_2 \longrightarrow CH_3-CH=CH-$ — propenyl

$CH_3-\underset{|}{C}=CH_2$ — isopropenyl

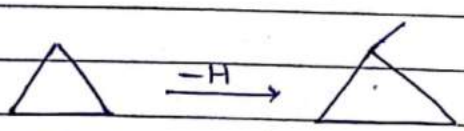
$-CH_2-CH=CH_2$ — Allyl

$CH\equiv CH \longrightarrow CH\equiv C-$ — ethynyl

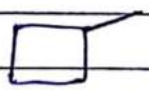
$CH_3-C\equiv CH \longrightarrow CH_3-C\equiv C-$ — propynyl

$-CH_2-C\equiv CH$ — propargyl

$CH_3-CH=CH-CH_2-$ — Crotyl



Cyclopropane — Cyclopropyl — cyclopropylidene



Cyclobutyl

Cyclopentyl

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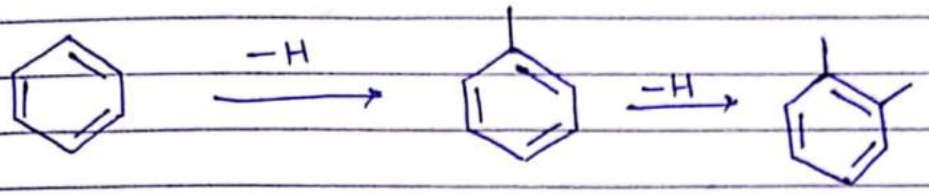
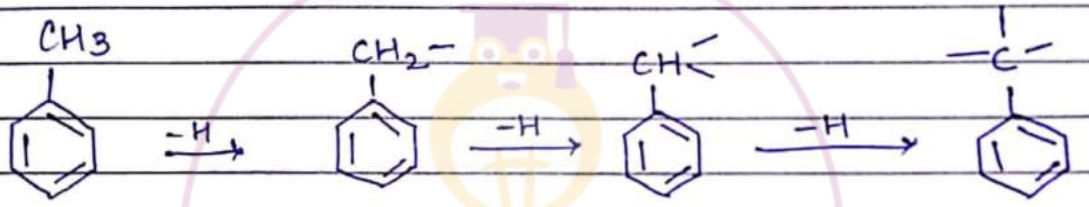
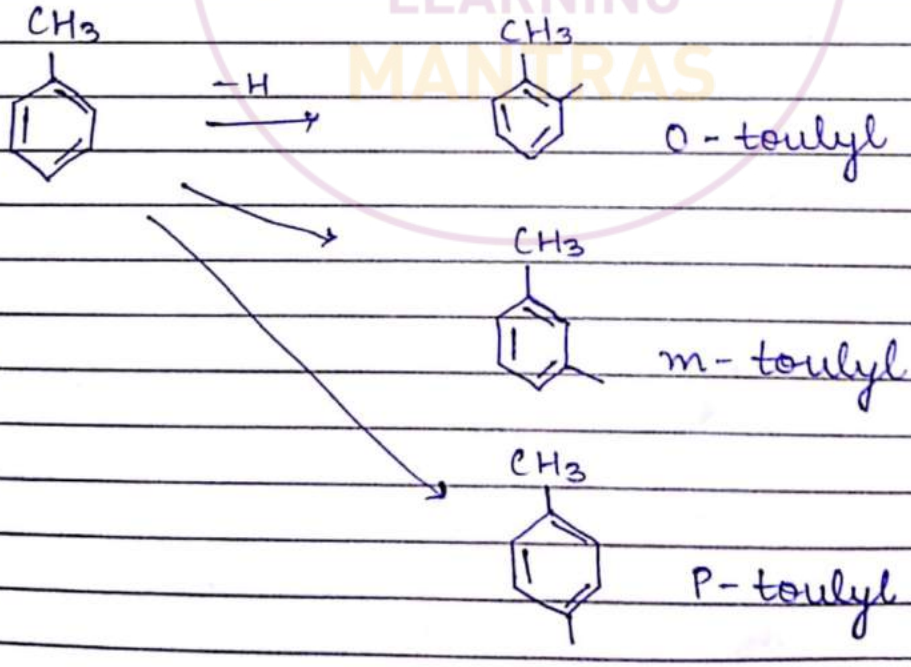
Aromatic :-



benzene or phene — phenyl — phenylene



toluene — benzyl — benzal — benzo

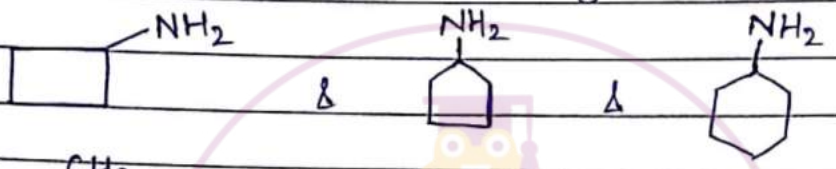


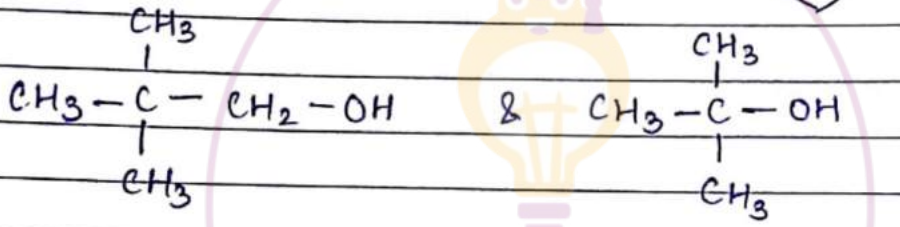
LEARNING MANTRAS

Concept of Homology :-

Those compds which have same structural features as well as same general formula but differ by $-CH_2-$ group c/a homologs & series is c/a homologous series.

CH_3-CH_2-OH & $CH_3-CH_2-CH_2-OH$





	G.F.	
alkane	C_nH_{2n+2}	CH_4, CH_3-CH_3, $CH_3-CH_2-CH_3$
alkene	C_nH_{2n}	$CH_2=CH_2$, $CH_3-CH=CH_2$, $CH_3-CH_2-CH=CH$
alkyne	C_nH_{2n-2}	$CH\equiv CH$, $CH_3-C\equiv CH$
Alcohol	$C_nH_{2n+2}O$	CH_3-OH, CH_3-CH_2-OH, $CH_3-CH_2-CH_2-OH$
ether	C_nH_{2n+O}	CH_3-O-CH_3, $CH_3-O-CH_2-CH_3$
Halide	$C_nH_{2n+1}X$	
aldehyde or	$C_nH_{2n}O$	$H-\overset{\overset{O}{\|}}{C}-H$, $CH_3-CH=O$, CH_3-CH_2-CHO
Ketone	$C_nH_{2n}O$	$CH_3-\overset{\overset{O}{\|}}{C}-CH_3$
acid/ester	$C_nH_{2n}O_2$	$H-\overset{\overset{O}{\|}}{C}-OH$, CH_3-COOH

LEARNING MANTRAS

Characteristics of Homologues :-

1. Have same general formula i.e. same method of preparation.
2. Have same type of atom.
3. have same functional gp. hence similiar chemical property.
4. Have different physical property.
5. 2 successive members differ by CH_2- gp i.e. a weight of 14 unit.

$R-CH_3$ $\xrightarrow{-CH_2}$ $R-H$ (Lower Homologue)

$R-CH_3$ $\xrightarrow{+CH_2}$ $R-CH_2-CH_3$ (Higher Homologue)

Ques Write lower & higher homologue of isopentyl alcohol.

$$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-OH$$

Higher $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-CH_2-CH_2-OH$

Lower $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-OH$ isobutyl alcohol

Ques Which of the following is pair of Homologues?

1. $CH_3-CH_2-CH_2-NH_2$ & $CH_3-\underset{\underset{CH_3}{|}}{CH}-NH_2$ X

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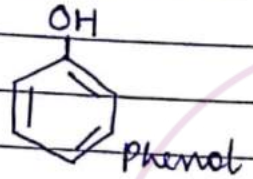
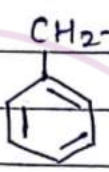
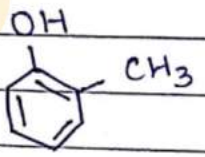
2. CH_3-CH_2-OH & $CH_3-CH_2-O-CH_3$ ✗

3. $H-\underset{\underset{O}{\|}}{C}-H$ & CH_3-CHO ✓

4. $CH_3-CH=CH_2$ & $CH_3-CH_2-\underset{\underset{H}{|}}{C}=CH_2$ ✓

5. CH_3-CH_2-Cl & CH_3-CH_2-Br ✗

6.  Phenol &  alcoholic ✗

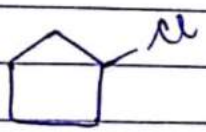
7. &  ✓

8. $CH_3-CH=CH_2$ & ✗

9. $CH_3-CH_2-NH_2$ & $CH_3-CH_2-NH-CH_3$ ✗

10. $CH_3-\underset{\underset{O}{\|}}{C}-CH_3$ & $CH_3-CH_2-CH_2-CH=O$ ✗

11. $CH_3-CH_2-CH_2-OH$ & CH_3-O-CH_3 ✗

12.  & ✓

13. $HCOOH$ & CH_3COOH ✓

14. $CH_3-\underset{\underset{O}{\|}}{C}-OH$ & $CH_3-O-\underset{\underset{O}{\|}}{C}-CH_3$ ✗

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15. $CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$ & $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ ✓

16. $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-Cl$ & $CH_3-CH_2-CH_2-Cl$ ✗

Nomenclature :-

- Common Name
- Derived Name
- IUPAC system

1. Common Name OR TRIVAL NAMING :-

- based on source of origin.

Structure	Source	Common Name
CH_4	Marshy area	Marsh Gas
CH_3-OH	distillation of wood	wood spirit
$HCOOH$	formica (Red Ant)	formic acid
CH_3-COOH	acetum (Vinegar)	acetic acid
$CH_3-\underset{\underset{OH}{|}}{CH}-COOH$	Milk	Lactic acid
C_3H_7-COOH	Butter	butyric acid
$HOOC-CH_2-\underset{\underset{OH}{|}}{CH}-COOH$	Apple	Malic acid
$HOOC-\underset{\underset{OH}{|}}{CH}-\underset{\underset{OH}{|}}{CH}-COOH$	~~tour~~ tamarind	tataric acid

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$HOOC-CH_2-\underset{\underset{OH}{|}}{CH}-CH_2-COOH$ Citrus fruit Citric acid

(R) — (G1)
hydrocarbon func gp

Common Name
Functional Group

① Non-Terminating (without C containing func gp)
eg $-OH, -NH_2, -O-, -\overset{\overset{O}{\|}}{C}-$

② terminating (C containing func gp)
$-COOH, -CHO$

1. Non terminating

	Suffix
$-OH$	alcohol
$-SH$	thio alcohol
$-X$	Halide
$-NH_2$	amine
$-\underset{H}{N}-$	amine
$-\underset{\underset{}{|}}{\overset{}{N}}-$	amine
$-O-$	ether
$-S-$	thio ether
$-\overset{\overset{O}{\|}}{C}-$	Ketone

Polyvalent func gp:-
1. If same hydrocarbon gp is attached then di, tri, tetra etc used.
2. If diff. hydrocarbon are attached then write them in alphabatical order

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Note: di, tri, tetra, primary, secondary, etc. are not considered in alphabatical order while terms iso, neo are considered in aphabetical order

CH_3-O-CH_3 — dimethyl ether

$CH_3-O-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ — isopropyl methyl ether

$CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_3$ — dimethyl ketone

$CH_3-\overset{\displaystyle O}{\overset{||}{C}}-CH_2-CH_3$ — ethyl methyl ketone

CH_3-CH_2-OH — ethyl alcohol

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-Cl$ — isopropyl chloride

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-NH_2$ — isobutyl amine

$CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2-OH$ — neo pentyl alcohol

$CH_2=CH-Cl$ — Vinyl chloride

$CH_2=CH-CH_2-OH$ — Allyl chloride

$CH_3-NH-CH_3$ — dimethyl amine

$CH_3-\underset{\displaystyle \underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3}{\underset{|}{N}}-CH_2-CH_3$ — ethyl isopropyl methyl amine

LEARNING MANTRAS

Terminating fun^{c} gp :-

Prefix :-

Total no. of C	Prefix
1C	form
2C	acet
3C	propion
4C	butyr → n, iso
5C	Valer

3C + 1db	C-C=C	acryl
4C + 1db	C-C=C-C	croton

Suffix :-

P. fg	Suffix
$-COOH$	ic acid
$-\overset{O}{\overset{\|}{C}}-O-R$	alkyl --- ate
$-\overset{O}{\overset{\|}{C}}-X$	yl halide
$-CHO$	aldehyde
$-\overset{O}{\overset{\|}{C}}-O-\overset{O}{\overset{\|}{C}}-$	ic anhydride
$-CN$	o nitrile
$-NC$	o iso nitrile
$-\overset{O}{\overset{\|}{C}}-NH_2$	amide

$H-\overset{O}{\overset{\|}{C}}-O-H$ formic acid

CH_3-COOH acetic acid

$CH_3-\underset{CH_3}{\underset{|}{CH}}-COOH$ isobutyric acid

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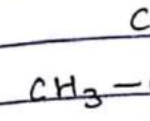
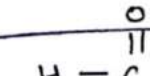
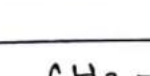
$CH_3-CH_2-CH_2-COOH$ — n-butyric acid

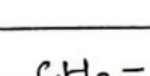

neo valeric acid


formaldehyde

$CH_3-CH=O$ — acetaldehyde

$CH_3-CH_2-CH=O$ — propionaldehyde


isobutyraldehyde

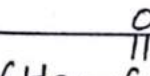

isovaler aldehyde

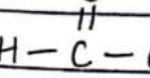
$CH_2=CH-CH=O$ — acryl aldehyde

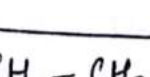
$CH_2=CH-COOH$ — acrylic acid

$CH_3-CH=CH-CHO$ — Croton aldehyde

$CH_3-CH=CH-COOH$ — crotonic acid


methyl acetate


ethyl formate


isopropyl ~~ethyl~~ acetate

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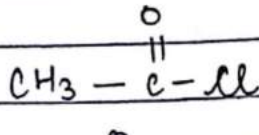
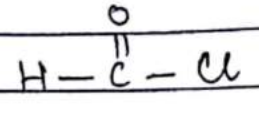

acetyl chloride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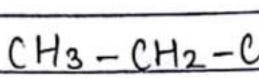
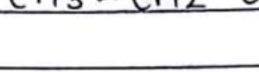
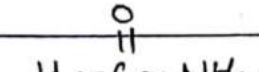
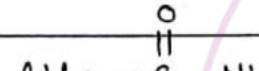
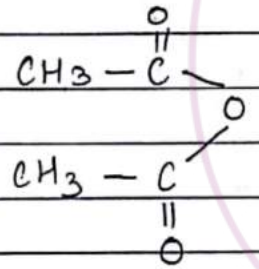
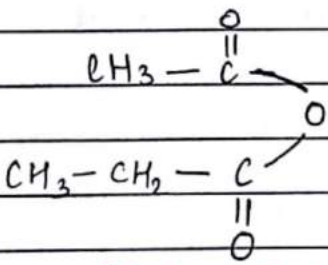

propionitrile


aceto isonitrile


formamide


acetamide


acetic anhydride


acetic propionic anhydride

DERIVED NAME :

(3) Based on famous Homolog

selection of parent chain
4°C > 3°C > 2°C > 1°C

alkane :- CH_4 methane

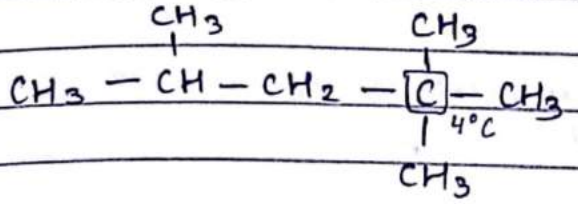
$CH_3-\boxed{CH_3}$ methyl methane

$CH_3-CH_2-\boxed{CH_2}-CH_3$ ethyl methyl methane

$CH_3-\underset{CH_3}{\boxed{CH}}-CH_2-CH_3$ ethyl dimethyl methane

LEARNING MANTRAS

Ques Write derived name of iso-octane?



isobutyl trimethyl methane

alkene : $CH_2=CH_2$ ethylene

Fg > multiple bond
=> =

$CH_2=CH-CH_3$ methyl ethylene

$CH_3-CH=CH-CH_3$ sym. dimethyl ethylene

unsym. dimethyl ethylene

alkyne : $CH\equiv CH$ acetylene

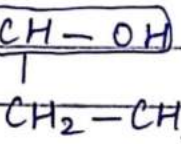
$CH_3-C\equiv CH$ methyl acetylene

$CH_3-C\equiv C-CH_2-CH_3$ ethyl methyl acetylene

$CH_2=CH-C\equiv CH$ Vinyl acetylene

alcohol : CH_3-OH Carbinol

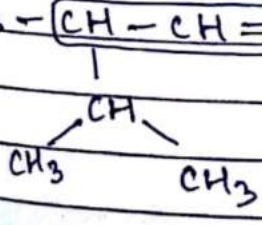
$CH_3-CH_2-CH_2-OH$ ethyl carbinol



ethyl methyl carbinol

aldehyde : $CH_3-CH=O$ acetaldehyde

$CH_3-CH_2-CH=O$ methyl acetaldehyde



isopropyl methyl acetaldehyde

acid : CH_3-COOH acetic acid

$CH_3-\underset{\underset{CH_2-CH_3}{|}}{CH}-COOH$ ethyl methyl acetic acid

Cl_3CCOOH

$Cl-\underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{C}}-COOH$ trichloro acetic acid

Ketone : $CH_3-\underset{\underset{O}{||}}{C}-CH_3$ acetone

$CH_3-CH_2-\underset{\underset{O}{||}}{C}-CH_2-CH_2-CH_3$

ethyl methyl acetone

IUPAC Naming

International Union of Pure & Applied Chemistry

Parts of IUPAC

1. Word Root
2. Prefix — [Pri, Sec.
3. Suffix — [Pri., Sec.

LEARNING MANTRAS

Secondary Prefix	Primary Prefix	Word Root	Primary Suffix	Secondary Suffix
2°	1°	WR	1°	2°
substituent is written in alphabetical order - Cl chloro - NO_2 Nitro	used when compd is cyclic "cyclo"	represent total no. of C in Principal C chain 1C - meth 2C - eth 3C - Prop ⋮ 10C - dec 11C - undec 12 - dodec ⋮ 20 Eicos	tells whether compd. is saturated or unsaturated C - C ane 1C = C ene 1C ≡ C yne 2C = C diene 2C ≡ C diyne C=C & C≡C enyne	tells about Principal func gp. - COOH - CHO - OH - NH_2

PRIORITY ORDER of FUNCTIONAL GROUP :-

Functional Grp.	Prefix	Suffix
-(C)OOH (carboxylic acid)	x	oic acid
-COOH	carboxy	carboxylic acid
$-SO_3H$ (Sulphonic acid)	sulpho	sulphonic acid
$-(C)(=O)-O-(C)(=O)$ (anhydride)	x	oic anhydride

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Functional Group	Prefix	Suffix
-(C)OOR (ester)	X	alkyl --- oate
-COOR	alkoxycarbonyl or carbalkoxy	alkyl --- carboxylate
-(C)OX (acidhalide)	X	oyl halide
-COX	halo formyl	carbonyl halide
-(C)ONH$_2$ (amide)	X	amide
-CONH$_2$	carbamoyl	carboxamide
-(C)N (cyanide)	X	Nitrile
-CN	cyano	carbonitrile
-N$\rightleftharpoons$(C) (isocyanide)	X	isonitrile
-NC	isocyano/ carbyl amino	carbyl amine
-(C)HO (aldehyde)	oxo	al
-CHO	formyl	carbaldehyde
-(C)- (Ketone) ‖ O	Keto/oxo	one
-OH (alcohol)	hydroxy	ol
-SH (thio alcohol)	mercapto	thiol
-NH$_2$ (amine)	amino	amine

Substituents	Prefix
-R	alkyl
-X	halo
-NH$_2$	amino
$-N^{=O}_{\rightarrow O}$	nitro
-O-N=O	nitrite
-N=O	nitroso

LEARNING MANTRAS

Substituents	Prefix
$-OCH_2CH_3$	ethoxy
$-CH_2-OH$	hydroxy methyl
$-CH_2-Cl$	chloro methyl
$-NH-CH_3$	methyl amino
$-S-$	thio
$-S-R$	alkyl thio
$CH_3-\overset{\overset{O}{\|}}{C}-O-$	acetoxy / ethanoyloxy
$CH_3CH_2-\overset{\overset{O}{\|}}{C}-O-$	propanoyloxy
$C_6H_5-\overset{\overset{O}{\|}}{C}-O-$	benzoyloxy
$-OR$	alkoxy

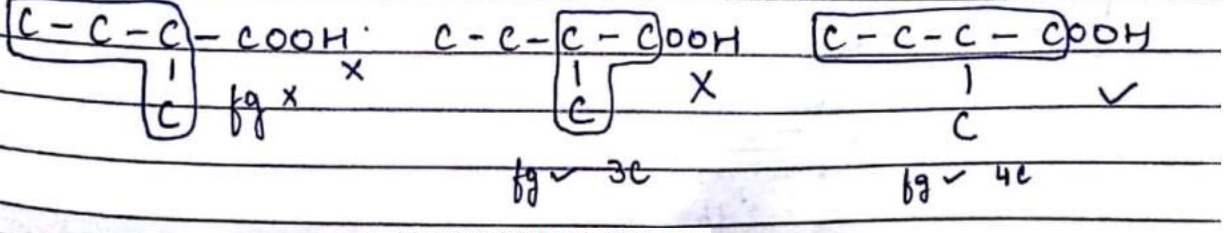
Rules of IUPAC :-

1. Selection of Principal Carbon chain
2. Numbering of P.C.C.

1. Selection of Principal Carbon Chain (-PCC)

P.C.C. will be that ~~largest~~ longest continuous chain of carbon which have

Pfg > Max^m no. of multiple bond > max. no. of C-atom



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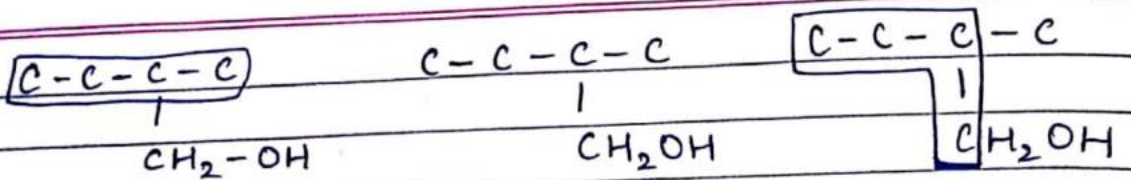
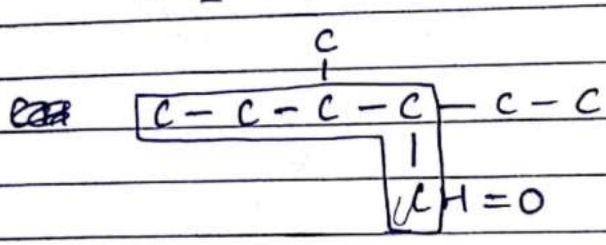
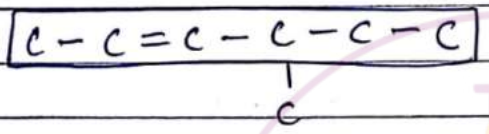
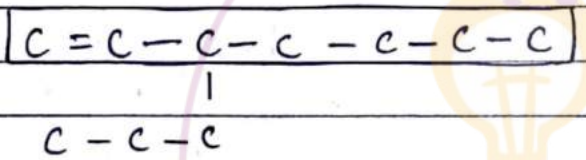
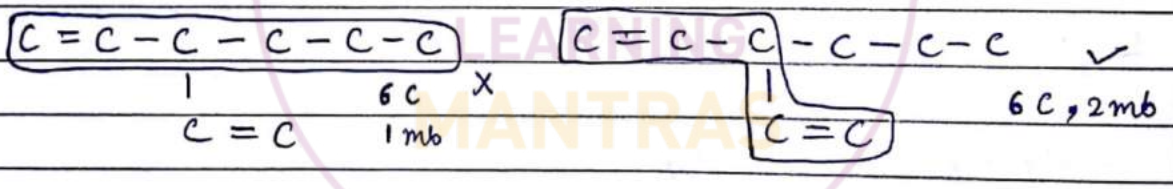
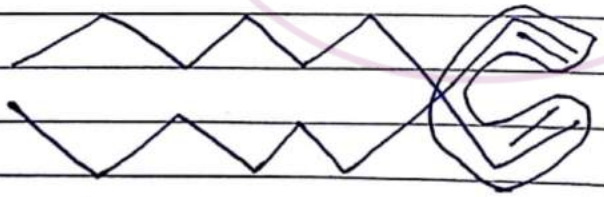




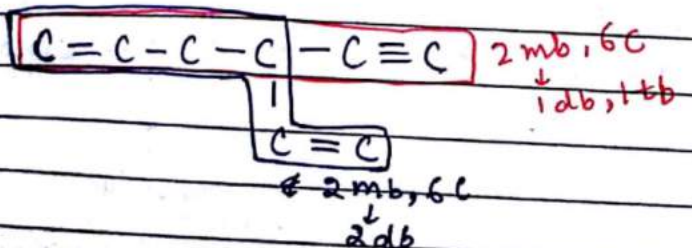


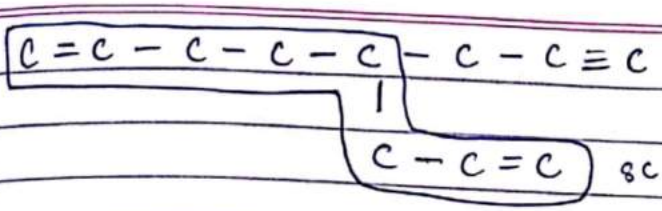


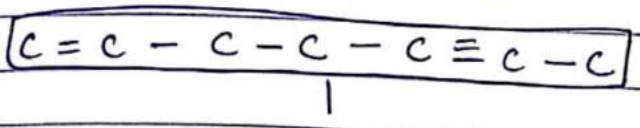


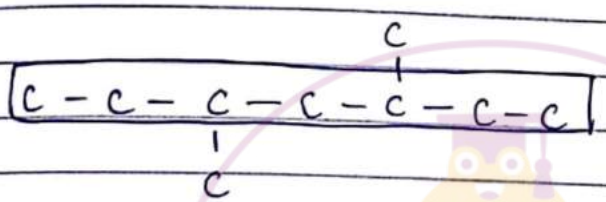


If symmetric molecule is +nt then priority is given to double & bond over triple bond

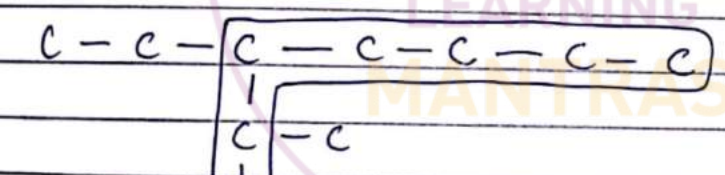


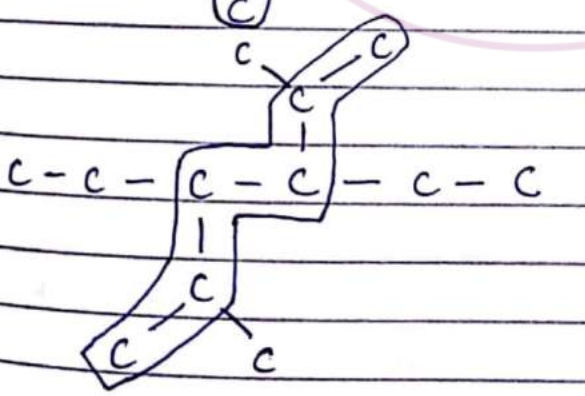


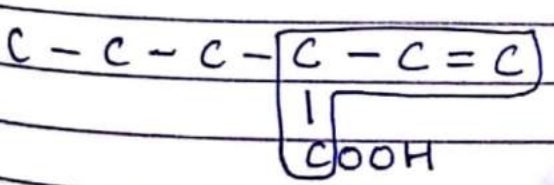




If 2 diff. P.C.C. have same no. of C in a molecule ~~the~~ then that P.C.C. will be selected as P.C.C. which have max^m no. of Sb (/ more branching)



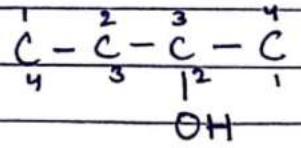




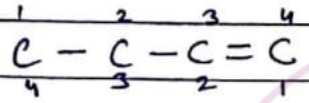
LEARNING MANTRAS

Numbering of P.C.C.:-

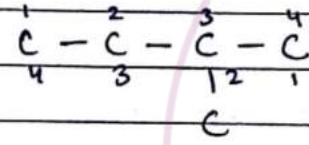
① Lowest no. will given to Pfg > Mb > Sb



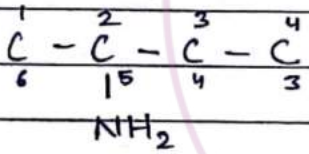
	fg
LHS	3
RHS	2



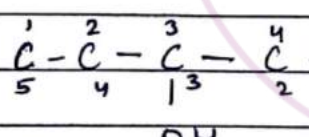
	mb
LHS	3
RHS	1



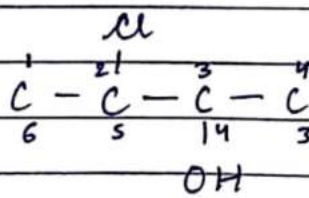
	Sb
L.H.S	3
RHS	2



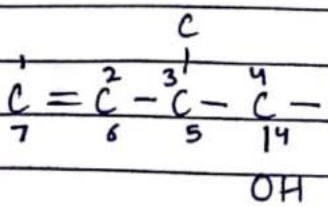
	fg
LHS	2
RHS	5



	fg	mb
LHS	3	4
RHS	3	1



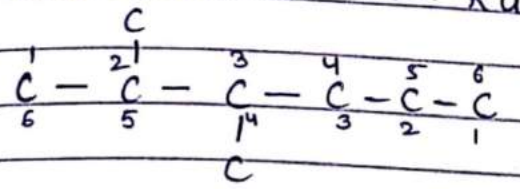
	fg
LHS	3
RHS	4



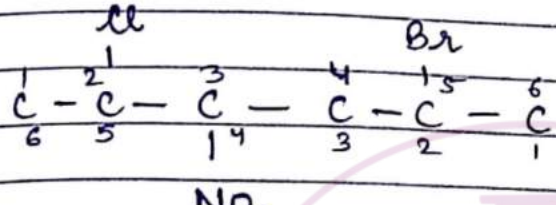
	fg	mb	sb
LHS	4	1, 6	3
RHS	4	1, 6	5

LEARNING MANTRAS

(2) If more than one substituent are +nt then least ~~low~~ locant no. Rule is followed.

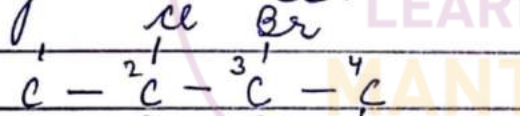


Sb
LHS 2,3 ✓
RHS 4,5

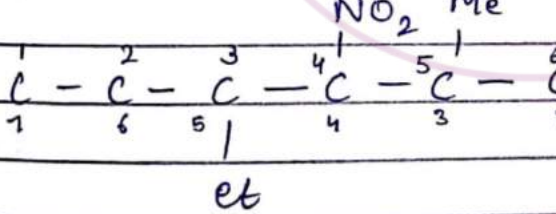


Sb
LHS 2, 3, 5 ✓
RHS 2, 4, 5

3. If 2 or more substituent are +nt at same posⁿ from either side then no. ~~of~~ starts from the side where alphabetically prefered substituent get lowest no.

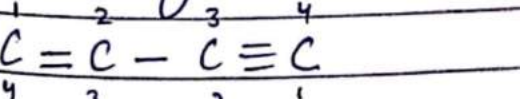


LHS 2, 3
RHS or 2, 3 ✓



LHS 3 4 5 ✓
RHS 3 4 5

4. If db & tb are at similiar posⁿ from either side of PCC then priority is given to db ⁿ



LHS 1, 3 ✓
RHS 1, 3

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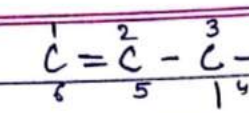
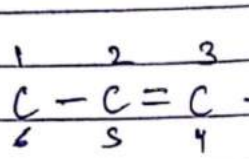
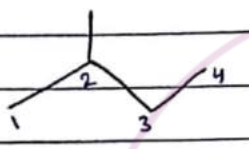


mb
db ← 1,5 3,4
LHS
RHS 1,5 3,4
tb

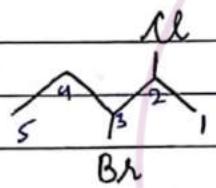


mb
LHS 2,5
RHS 1,4 ✓

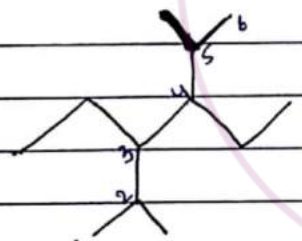
Ques



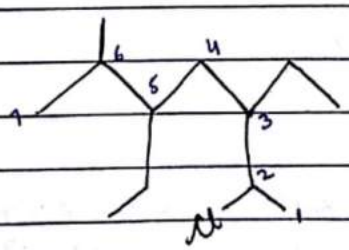
2-Methyl Butane



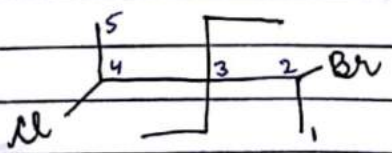
3-Bromo-2 Chloro Pentane



3,4 diethyl-2,5 dimethyl Hexane



2-Chloro-3,5-diethyl-6-methyl heptane



2-Bromo-4-Chloro-3,3-diethyl Pentane

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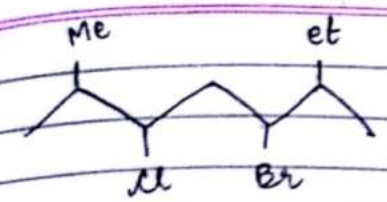
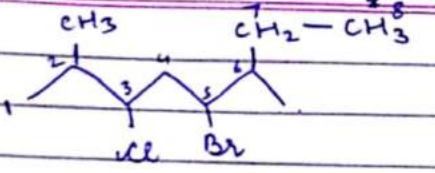
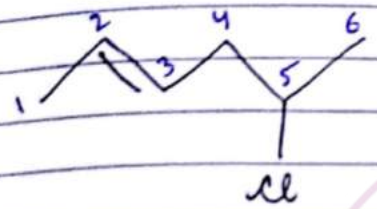
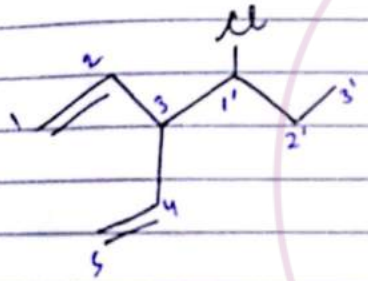




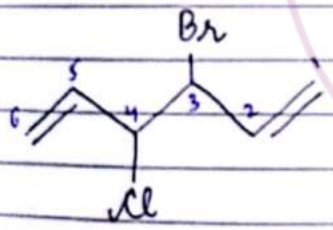
5-Bromo-3-Chloro, 2,6-dimethyl Octane



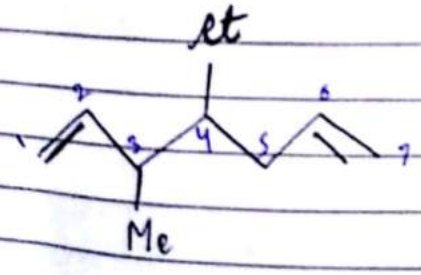
5-Chloro-~~Hex~~ Hex-2-ene



3(1'-Chloro Propyl) ~~Hex~~ Pent-1,4-diene



3-Bromo-4-Chloro hex-1,5 diene



4-ethyl-3-methyl-hept-1,6-di ene

$CH_2 = CH - CH_2 - C \equiv CH$ Pent-1-ene-4-yne

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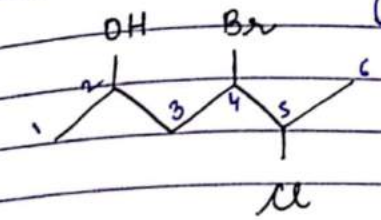
AIPMT-10

$CH_3 - \overset{6}{CH} = \overset{5}{CH} - \overset{4}{CH_2} - \overset{3}{C} \equiv \overset{2}{CH}$

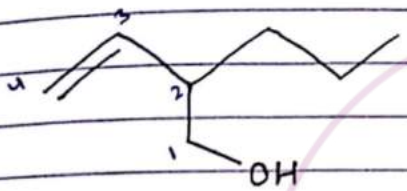
Hex - 4 - ene - 1 - yne

$CH_3 - \overset{3}{\underset{\|}{C}} - \overset{2}{\underset{\|}{C}} - CH_2 - CH_3$
$\quad\quad\quad

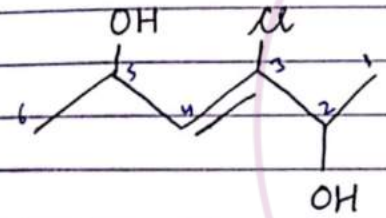
	Prefix	Suffix
-OH	Hydroxy	ol



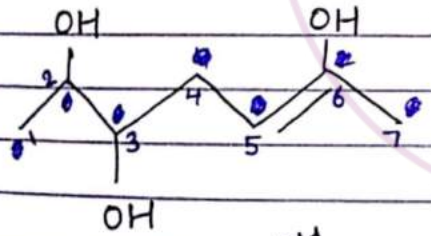
4 - Bromo - 5 - Chloro - 2 - Hexanol



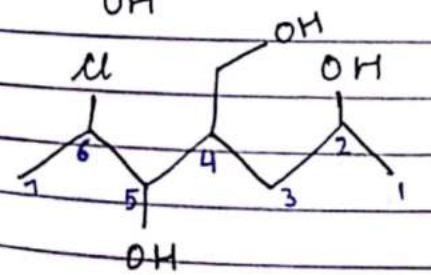
2 - Propyl - But - 3 - ene - 1 - ol



3 - Chloro - Hex - 3 - ene - 2, 5 - diol



hept - 5 - ene - 2, 3, 6 - triol



6 Chloro - 4 hydroxy Methyl hept - 2, 5 - diol

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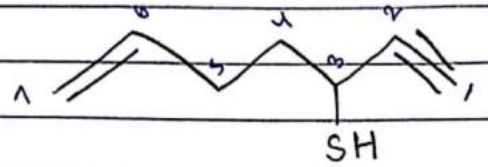
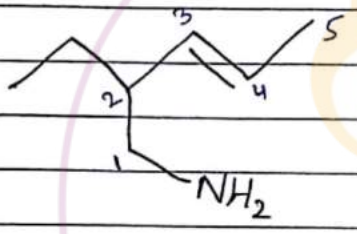
	Prefix	Suffix
$-SH$	mercapto	thiol

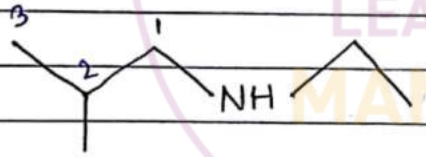


Hept - 6 - ene - 1 - yne - 3 - thiol

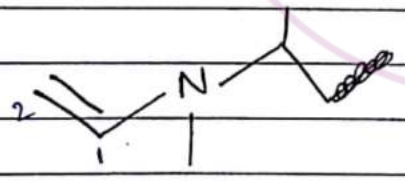
	Prefix	Suffix
$-NH_2$	amino	amine



2 - Ethyl - Pent - 3 - ene - 1 - amine

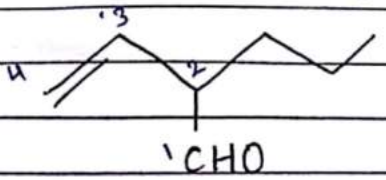


N - ethyl - 2 - methyl Propan amine



N - isopropyl - N - methyl ethene amine

	Prefix	Suffix
$-CHO$	~~oxo~~ formyl	al carbaldehyde



2 - Propyl But - 3 - ene al

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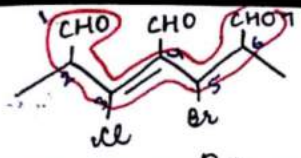
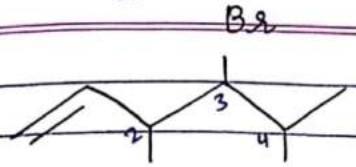


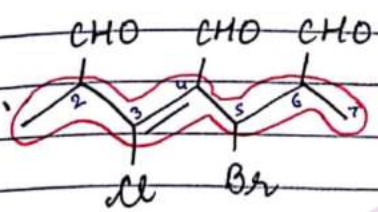
5-Bromo-3 Chloro-4-formyl-2,6-dimethyl heptan-1,7-dial

PAGE NO.: 43
DATE: / /

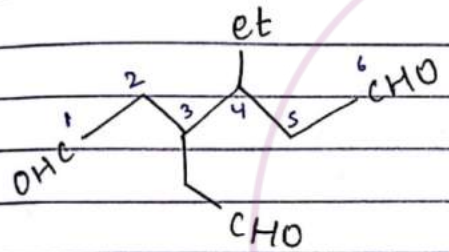


3-Bromo-2-ethenyl-4-methyl Pentan-1,5-dial

Note: When more than 2 carbon containing same func gp are attached to main chain then exclude all of them.

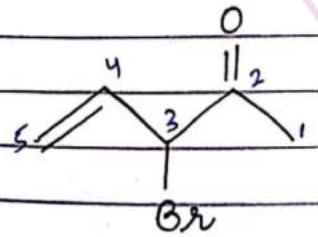


5-Bromo-3-Chloro hept-3-ene-2,4,6-tricarbaldehyde

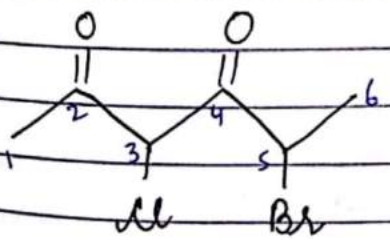


4-ethyl-3-formyl methyl-hexan-1,6-dial

Prefix	Suffix
oxo / keto	one



3-Bromo-Pent-4-en-2-one



5 Bromo-3-Chloro hexan-2,4-dione

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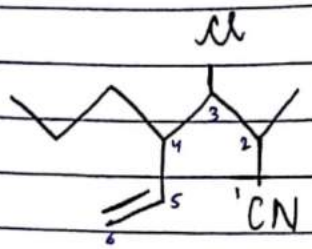
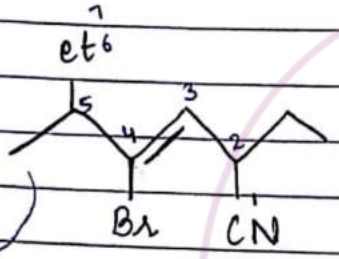
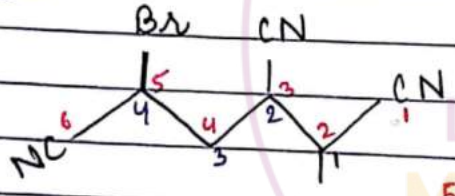
$-CN$ $-(C)N$ $-CN$ × cyano nitrile carbonitrile



3-Chloro-2-Methyl-4-Propyl-hex-5-ene nitrile



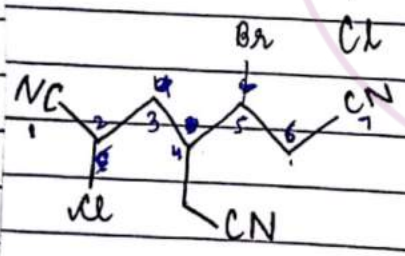
4-Bromo-2-ethyl-5-Methyl hept-3-ene nitrile



Pfg
CHS 1,3,4
RHS 1,2,4

4-Bromo-1-Chloro butane-1,2,4-carbo nitrile

5-Bromo-2-Chloro-3-cyano hexane-1,6-dinitrile



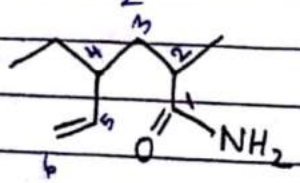
5-bromo-2-Chloro-4-cyano methyl heptane-1,7-dinitrile

$-\overset{O}{\overset{\|}{C}}-NH_2$

$-(\overset{O}{\overset{\|}{C}})-NH_2$

$-\overset{O}{\overset{\|}{C}}-NH_2$

× carbamoyl amide carboxamide



4-Ethyl-2-Methyl-hex-5-ene amide

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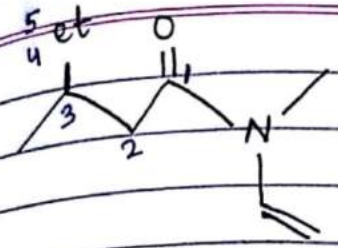
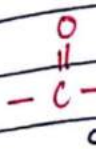
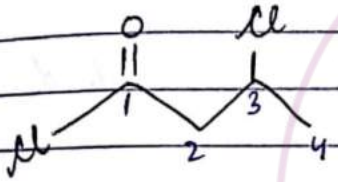


N - ethenyl - 3, N - dimethyl Pent -anamide

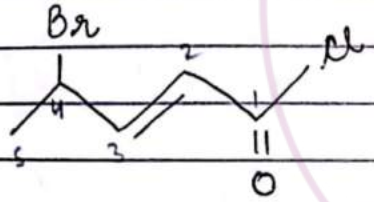


X — oyl halide

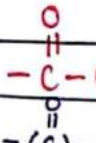
halo formyl — carbonyl halide



3 - Chloro - Butanoyl Chloride

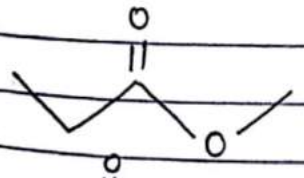


4 - Bromo - Pent - 2 - eneoyl Chloride

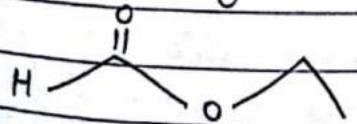


X — alkyl --- oate

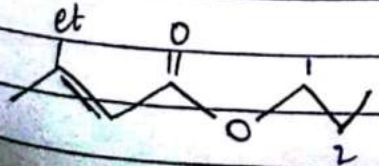
alkoxy carbonyl — alkyl --- carboxylate



methyl - Propanoate



Ethyl - Methanoate



Propyl Ethyl - 3 - Methyl - Pent 2 - ene oate

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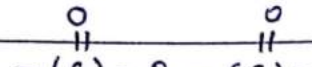
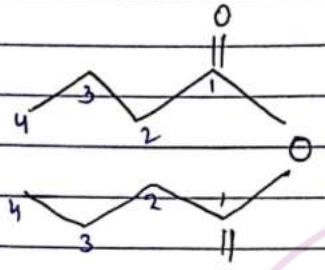
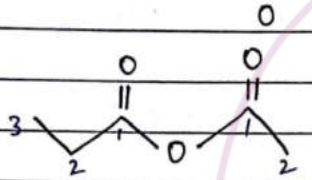


x oic anhydride

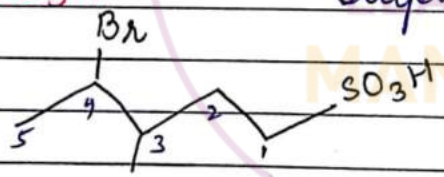


Butanoic anhydride



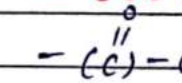
Ethanoic - Propanoic anhydride

$-SO_3H$ Sulpho sulphonic acid

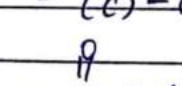


4-Bromo-3-Methyl Pentane sulphonic acid.

$-COOH$

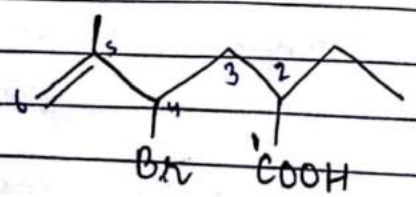


x oic acid



Carboxy carboxylic acid

et



4-Bromo-2,5-diethyl @. hex-5-ene-oic acid

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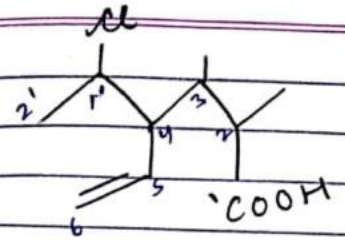
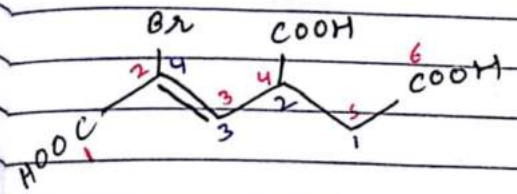


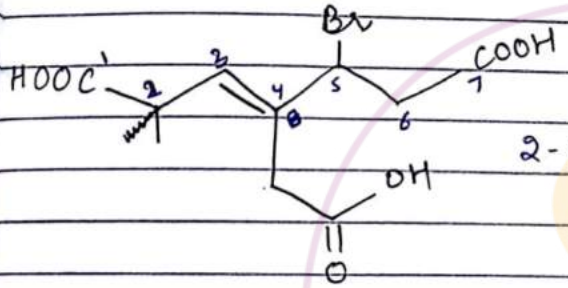
4 (1'-Chloro Ethyl) - 2, 3 - dimethyl hex - 5-ene - oic acid



2-bromo-4-carboxy hex-2-ene-1,6-dioic acid

But-3-ene-

4-Bromo-, 1, 2, 4-~~dicarboxy~~ dicarboxylic acid ~~Buta-~~ 3-~~ol~~ ene

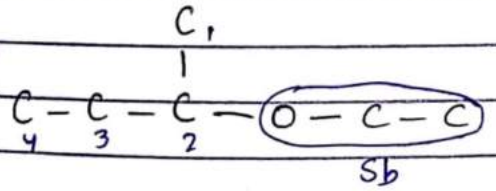


5-Bromo-4-carbony ~~ethyl~~ methyl 2-Methyl-Hept-3-ene-1,7-dioic acid

IUPAC Naming

$CH_3 - O - CH_3$ methoxy methane

$CH_3 - CH_2 - O - CH_3$ methoxy ethane



2 - ethoxy butane

$C - C - C - C - O - C = C$ butoxy ethene

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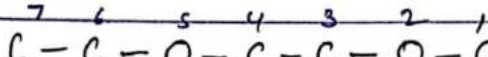
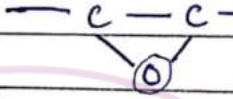
Oxa - System → O को C atom से से Least locant no. देनी है

2 - oxa - butane

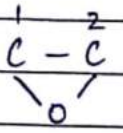


2,5 - dioxa heptane

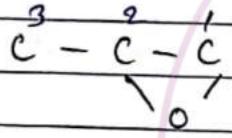
Cyclic ether



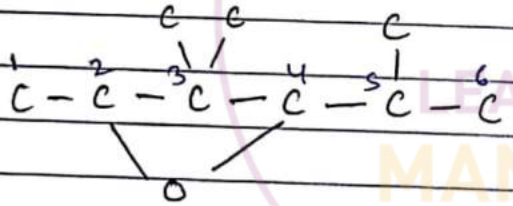
epoxy



epoxy ethane
~~Or~~ oxirane (trivial name)

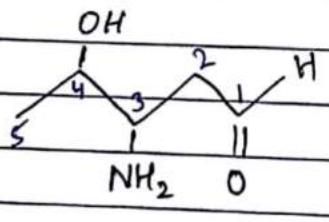


1, 2 - epoxy propane

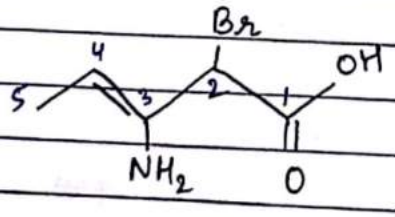


2,4-epoxy - 3,3,5-trimethyl hexane

IUPAC Naming of Polyfunctional group :-



3 - amino - 4 - hydroxy Pentanal



3 - amino - 2 - Bromo - Pent - 3 - ene oic acid

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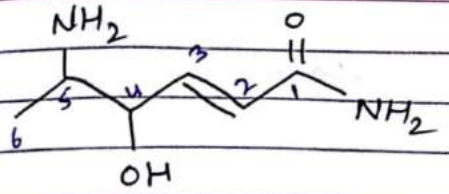
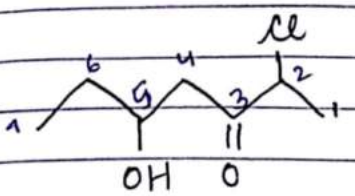
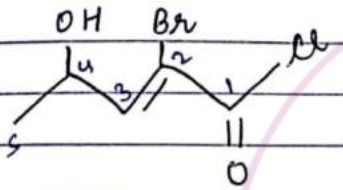


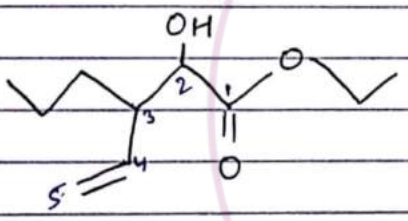
5 - amino - 4 - hydroxy hex - 2 - ene amide



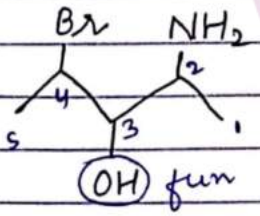
2 - Chloro - 5 - hydroxy heptan - 3 - one



2 - Bromo - 4 - hydroxy Pent - 2 - eneoyl Chloride

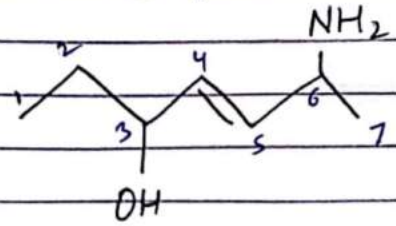


ethyl - 2 - hydroxy - 3 - Propyl Pent - 4 - eneoate

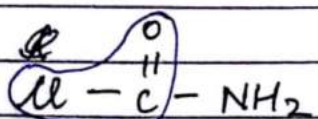


2-amino-4- ~~Bromo - 3 - hydroxy~~ Pentan~~amine~~ 3-ol

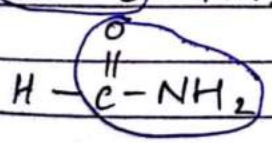
(OH) fun



6 - amino hept - 4 - ene - 3 - ol



amino · methanoyl chloride



methanamide

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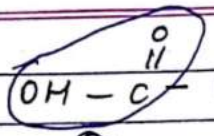
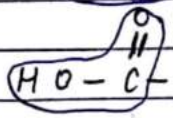
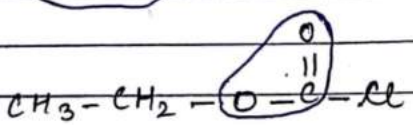
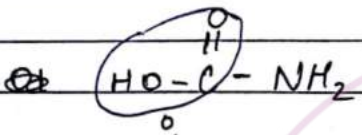
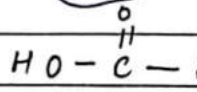
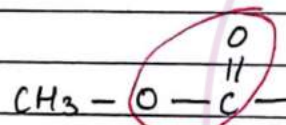

methoxy methanoic acid


Chloro methanoic acid

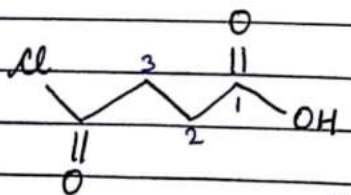

ethyl chloro methanoate

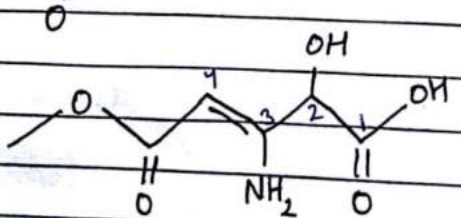

amino methanoic acid


methanoic acid


methyl amino methanoate

Note: In polyfunctional gp containing substance if C-containing func gp is not as substituents then its C is not considered in P.C.C. but in case of -CHO & $-\overset{\overset{O}{\|}}{C}-$ its C can be included in chain.


chloro formyl
3-~~methyl chloride~~ - Propanoic acid


3-amino-2-hydroxy-4-methyl carbonyl-3-butenoic acid

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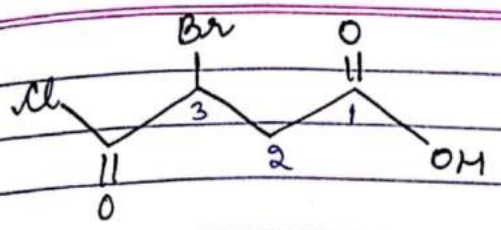
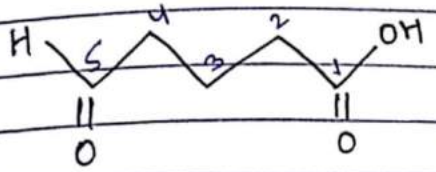
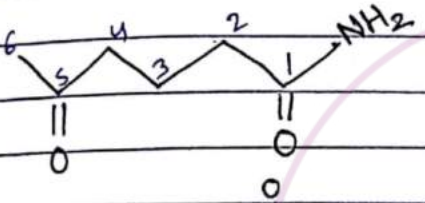


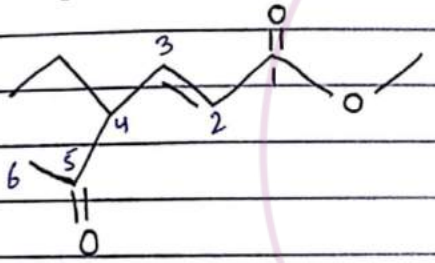
3 - Bromo - 3 - Chloroformyl Propanoic acid



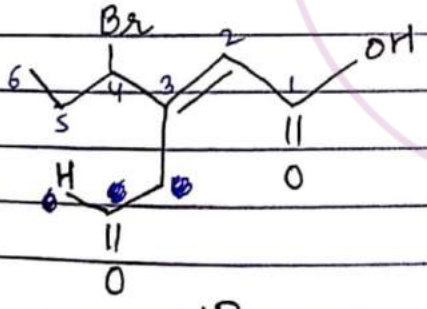
5 - Oxo - Pentanoic acid



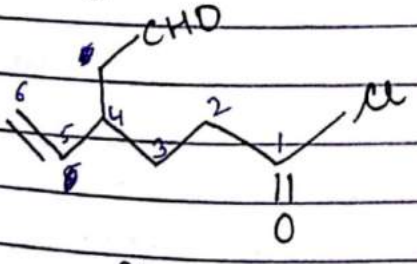
5 - Keto - Hexanamide



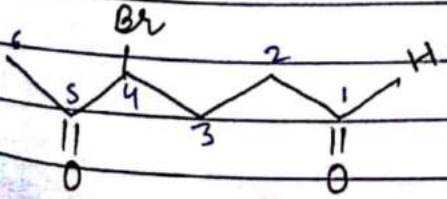
4 - ethyl - ~~methoxycarbonyl~~
5 - keto ~~Hex-2-ene~~ methyl Hex-2-ene oate



~~5 - Keto - 3 - Bromo Propyl Hex-2-ene oic acid~~
4 - Bromo - 3 - methyl formyl hex-2-enoic acid



formyl methyl
4 - ~~Methyl formyl~~ - 5 - hexenoyl chloride



4 - Bromo - 5 - keto Hexanal

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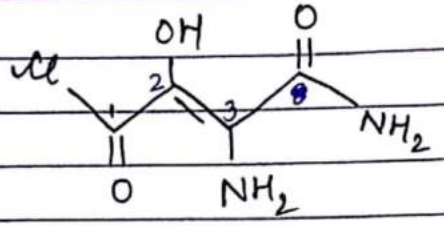
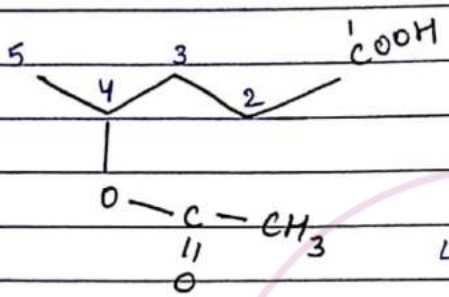


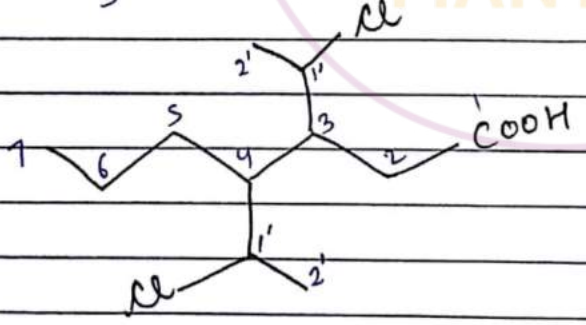
3 - amino - 3 - carbo amoyl
2 - hydroxy ~~Pr~~ Prop
- 2 ene - ~~chlor~~
oyl chloride



4 - ethanoyloxy pentanoic acid
or
4 - acetoxy Pentanoic acid

Complex Substitutent :-

3 isopropyl Pent - 4 - eneoic acid
or
3 (1'-methyl ethyl) pent - 4 - enoic acid



bis - 3,4 - (1'- Chloroethyl) heptanoic acid

IUPAC name of Cyclic compounds :-

Rule ① If an org. comp. is consist of open chains & closed chain then that chain will be PCC which have -

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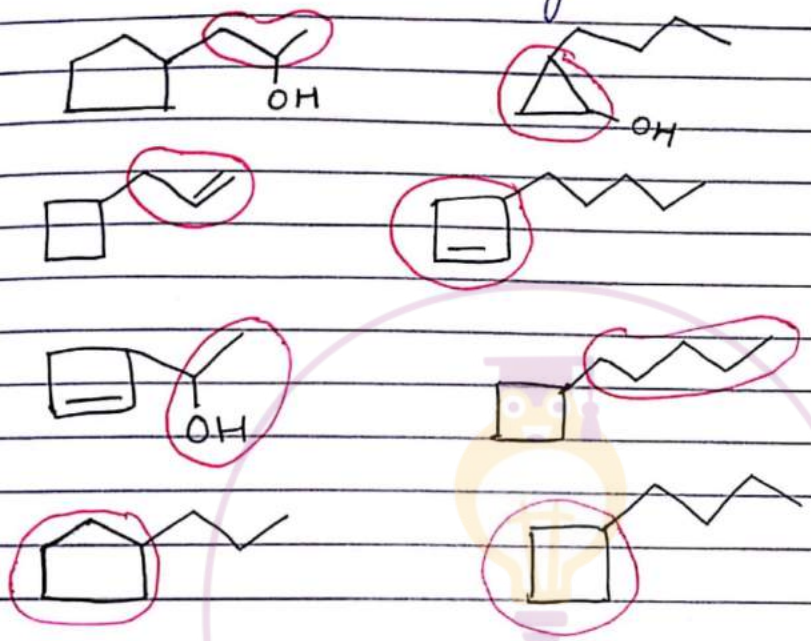
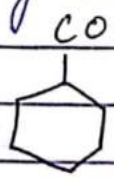
Pfg > max^m no. of m.b. > max^m no. of C-atom or longest chain > ring if open & closed chain have same no. of C-atom



Rule-2 If C-containing Pfg is directly attached to ring then it is consider as part of ring but its C is not included in P.C.C.



cyclo hexane carboxylic acid

cyclo hexane carbonitrile

Numbering as usual

Note:- ① ring prefix → cyclo
② Word cyclo is considered in alphabetical order

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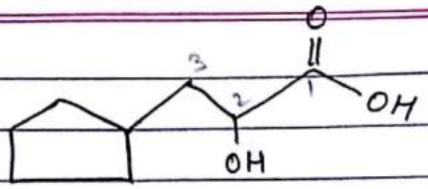
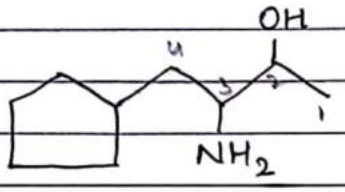
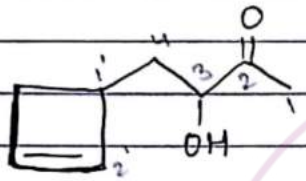


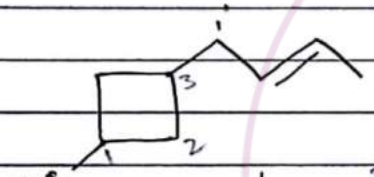
3-cyclo Pentyl-2-hydroxy Propanoic acid



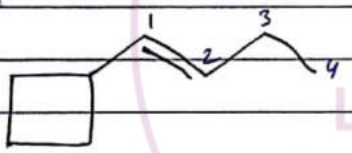
3-amino-4-cyclo Pentyl -Butan-2-ol



4(2'-cyclobutenyl)-3-hydroxy -2-butanone

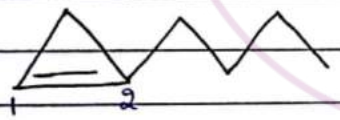


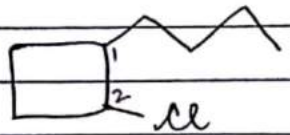
3(2'-butenyl) butanol



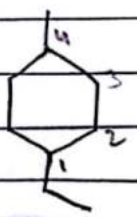
1-cyclo Butyl Buto-1-ene

2-Butyl-cyclo Propene





1-Butyl-2-Chloro-cyclo Butane



1-Ethyl-4-Methyl cyclo hexane

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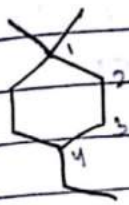
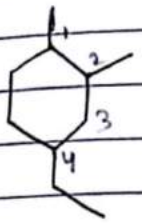
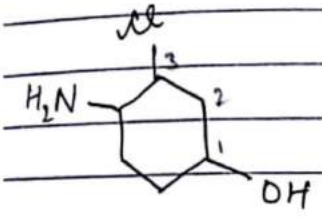


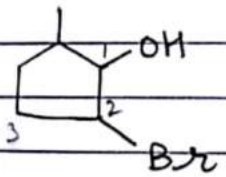
4-Ethyl-1,1-dimethyl cyclohexane.



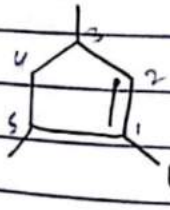
4-ethyl-1,2-dimethyl cyclo hexane



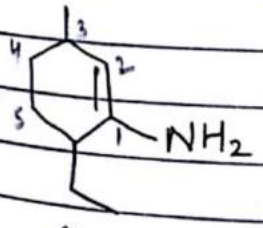
4-amino-3-chloro cyclo hexanol



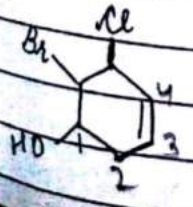
2-Bromo-5-methyl cyclo Pentanol



3,5-dimethyl cyclo Penteneol



6-Ethyl-3-Methyl cyclo Hexeneamine



6-Bromo-5-Chloro-cyclo hex-3-eneol

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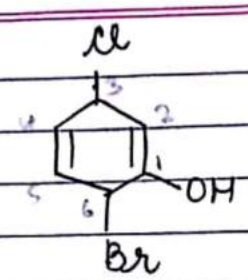
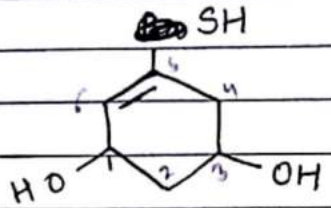
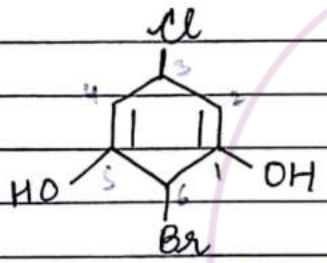
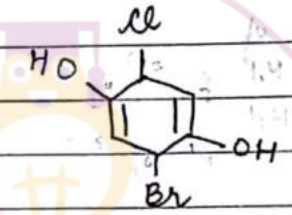


6 - Bromo - 3 - Chloro - cyclohex-1,4 -dienol



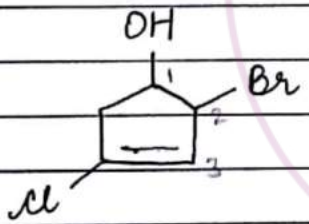
5- mercapto - cyclo - hex - 5 - ene - 1, 3 - diol



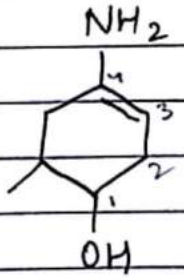


3- Bromo - 6 - Chloro cyclohex - 1,4 - diene - 1,4 - diol

6-Bromo - 3-Chloro cyclohiex - 1,4-di-ene-1,5-diol



2- Bromo - 4 - Chloro - cyclo Pent-3-enol



4- amino - 6 - methyl - cyclo hex-3-eneol

COCl

1 - carbonyl chloride - cyclohexane

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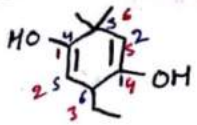
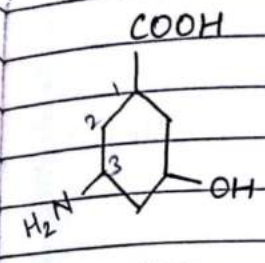


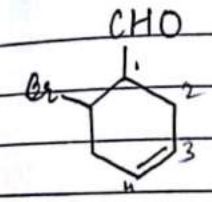
Pf	mb	sb
1,4	1,4	3,3,6 ✓
1,4	1,4	3,6,6

PAGE NO.: 57
DATE: / /

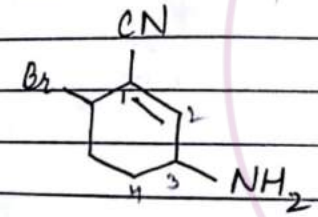
2- cyclo hexyl ethanal



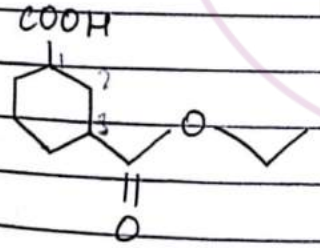
3- amino- 5- hydroxy - cyclohexane carboxylic acid



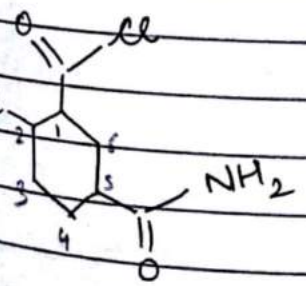
6- Bromo - cyclohex- 3- ene - carbaldehyde



3 - amino - 6 - Bromo - cyclohexene carbonitrile



3- ethoxy carbonyl - cyclo hexane carboxylic acid



2- Bromo - 5- carbamoyl cyclo- hexane carbonyl halide

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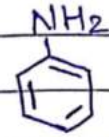
IUPAC Name of Aromatic

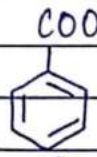
Benzene

toulene

Phenol

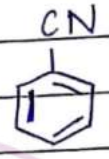


aniline

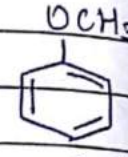


Benzoic acid

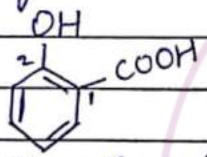
Benzaldehyde



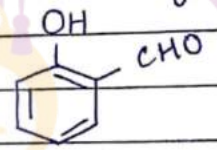
Benzonitrile



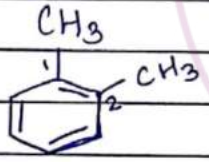
anisole



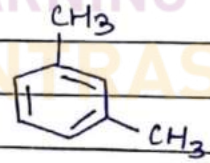
Salicyclic acid
2-hydroxy benzoic acid



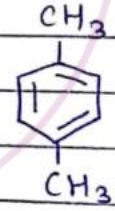
Salicyaldehyde
2-hydroxy benzaldehyde



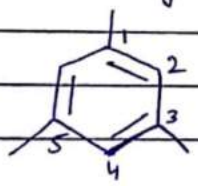
1, 2-dimethyl benzene
O-Xylene



m-Xylene



P-Xylene



1, 3, 5-trimethyl benzene
or
mesitylene

Rule: ~~Its~~ If aromatic compd is consist of open and closed chain then PCC will be
(1) which have P func gp.
(2) Open chain if it have more than 2 carbon

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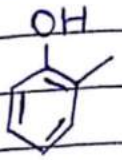
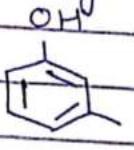
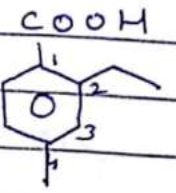
(in case when fun^{c} gp not +nt)



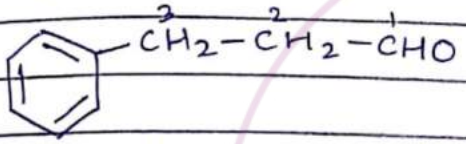
2-methyl Phenol
O-Cresol



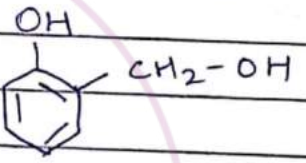


2-ethyl-4-methyl benzoic acid

2-phenyl ethanoic acid



3-phenol propanal



2-hydroxy methyl phenol
≡ (2-Hydroxy phenyl)-methanol

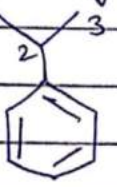
Phenol → phenolic gp

alcoholic gp

Alcoholic gp has more priority than phenolic gp.

methyl benzene

ethyl benzene



2-phenyl propane

1-Chloro-3 phenyl propane

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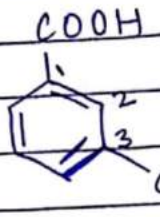
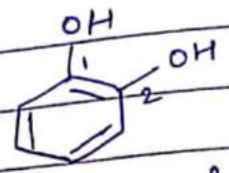
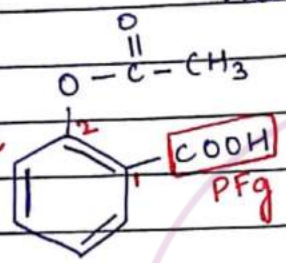
If more than 2 fun^{c} gp are +nt



benzene-1,3-dicarboxylic acid

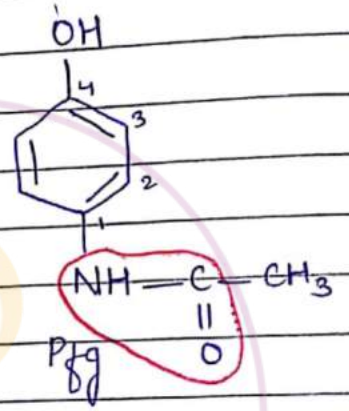


Catechol
benzene-1,2-diol

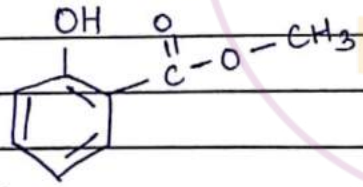


Aspirin

2-ethanoyl oxy benzoic acid
2-acetoxy benzoic acid
acetyl salicylic acid

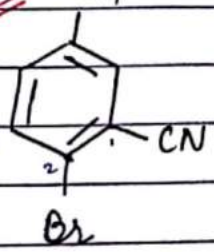


N-(4-hydroxy phenyl) ethanamide
Paracetamol



IUPAC
methyl-2-hydroxy Benzoate
common methyl salicylate
→"oil of winter green"

IIT-09



2-Bromo-5-hydroxy ~~phenyl cyano~~ benzo nitrile

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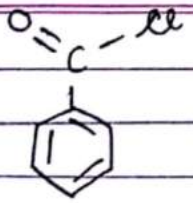
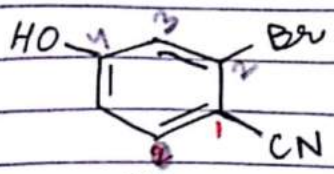
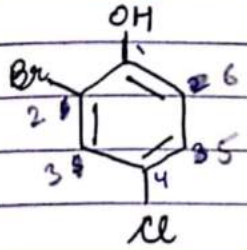


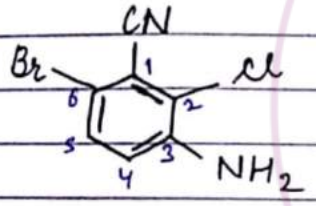
Benzene carbonyl chloride



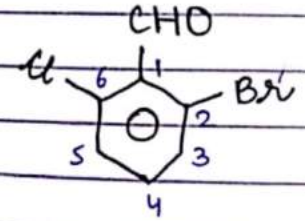
6 - Bromo - 4-hydroxy benzene ~~benzene~~ benzo nitrile



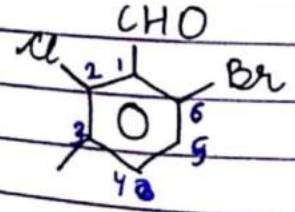
2 6 - Bromo - 4-Chloro - benzanol

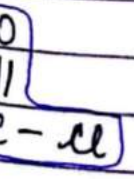


3 - amino - 6 - Bromo - 2 - Chloro ~~ide~~ Benzo - nitrile.



2 - Bromo - 6 - Chloro - Benzaldehyde





Phosgene gas

poisonous gas

Chloro - methanoyl chloride

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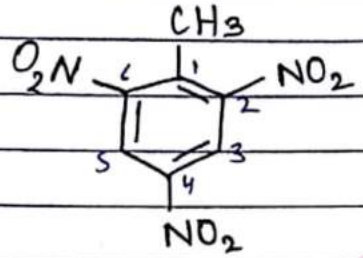
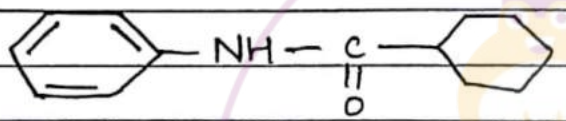
CCl_4 tetrachloro methane

$CHCl_3$ → chloroform / 1,1,1 - trichloro methane

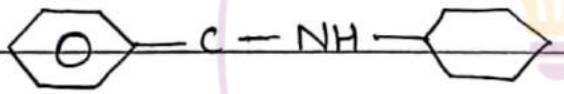
tear gas → $CCl_3.NO_2$
tri chloro nitro methane



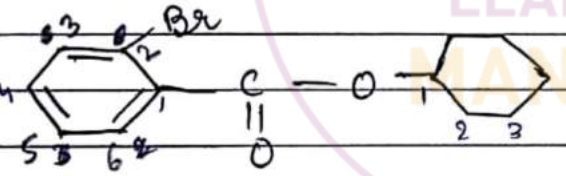
2,4,6 - trinitro toulene



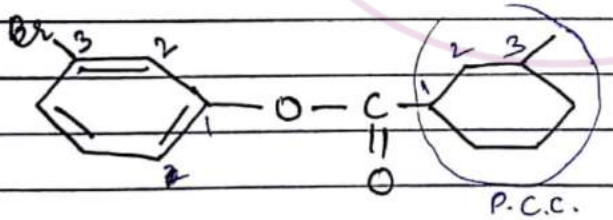
N - Phenyl ~~cyclo hexane carboxa~~ carboxamide ~~hexane~~



N - cyclo - hexyl benzene carboxamide



(4 - methyl cyclo hexyl) - 6 - Bromo Benzoate

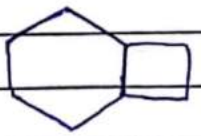


(5 - bromo phenyl) - 3 methyl cyclo hexane carboxylate

P.C.C.

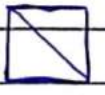
Bicyclo compounds

4 rings are fused



General formula → C_nH_{2n-2}

min C → 4C



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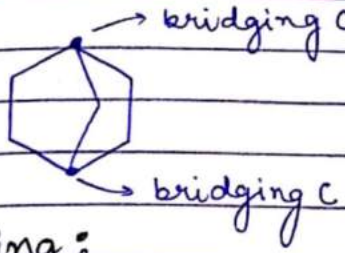
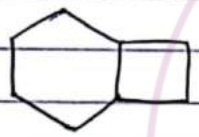
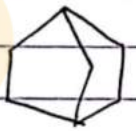


Naming:

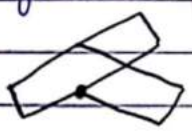
- Prefix → bicyclo
- no. of C-atoms in bridges are written in ↓ order in square bracket [ ] separated by full stop (.)
- word root → total no. of C-atom



bicyclo [4.2.0] Octane

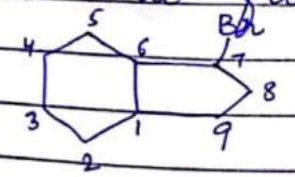


bicyclo [2.2.1] heptane

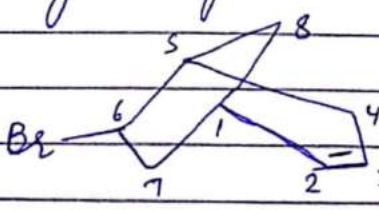


bicyclo [2.2.2] Octane

If subs. is +nt then numbering start from bridged carbon & then we move from large ring to small ring



bicyclo [4.3.0] -7-Bromo Nonane



bicyclo [3.2.1] 6-bromo-Oct-2-ene

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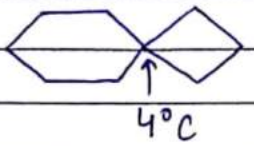
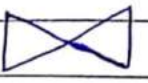
Spiro - compounds :-

When 2 rings are fused at common carbon (4°C)

eg 

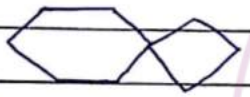
G.F. → C_nH_{2n-2}

min. no. of C → 5C

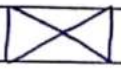


Naming :-

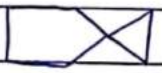
- Prefix spiro
- no. of C atoms in ring are written in ↑ order
- word root, suffix.



Spiro [3.5] nonane



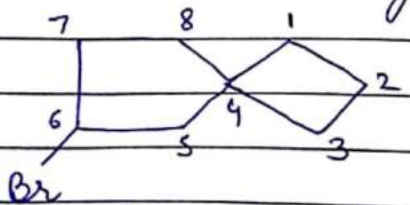
Spiro [2.2] Pentane



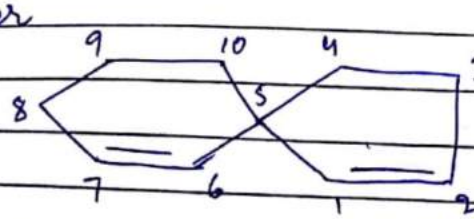
Spiro [2.4] heptane

* Sub is +nt

Numbering starts from adjacent carbon to common C & move through smaller ring to large ring



Spiro [3.4] - 6 - Bromo Octane



Spiro [4.5] dec - 1, 6 - diene

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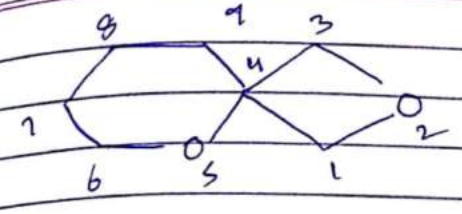
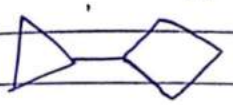
c)



spiro [3.5] 2,5 dioxa nonane

Extra different org i.e. no common carbon



1 - Chloro - 4 - Methyl benzene
4 - Chloro - toulene

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